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A

SYSTEM
OF
SURGERY:

BY

BENJAMIN BELL,

MEMBER OF THE ROYAL COLLEGES OF SURGEONS
OF EDINBURGH AND IRELAND,
ONE OF THE SURGEONS TO THE ROYAL INFIRMARY,
AND FELLOW OF THE ROYAL SOCIETY
OF EDINBURGH.

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A

SYSTEM

OF

SURGERY.

CHAPTER VI.

OF SUTURES.

SECTION I.

General Obſervations on Sutures.

AS ſutures are often neceſſary, not only in the treatment of wounds, but in almoſt every chirurgical operation, the ſubject obviouſly merits particular attention.

A variety of ſutures have been practiſed by ſurgeons, each of which has, from long experience, been applied to a particular purpoſe; namely, The interrupted ſuture; the quilled ſuture; the glovers', and the twiſted ſuture. Many others are enumerated by authors; but theſe four are the only ſutures at preſent in ordinary uſe; and even of theſe, ſome might with propriety be laid aſide.

The intention of every ſuture, is to unite parts, which, either by accident or deſign, have been divided. Another mode of effecting this, is through the intervention of adheſive plaſters: and this, by ſurgeons, has been termed the Falſe or Dry Suture, in oppoſition to thoſe that are performed by the needle, which are denominated the True or Bloody Suture.—But as the method of uniting divided parts, with the aſſiſtance of plaſters, has already been noticed in Chapter II. when treating of wounds, it will not be neceſſary to enter upon the ſubject here.

SECTION II.

Of the Interrupted Suture.

IN deep wounds, when a re-union of the the divided parts is intended, we, for the moſt part, have recourſe to the interrupted ſuture; but from what has already been fully explained, when treating of wounds, and from what will preſently further appear, it does not ſeem to be ſo well adapted to this purpoſe as the twiſted ſuture. When it is determined, however, to make trial of the interrupted ſuture, the following is the eaſieſt mode of performing it.

In every wound where ſutures are neceſſary, it has commonly been conſidered as good practice, to carry the needle and ligature to the bottom of the ſore, ſo as to give as little room as poſſible for matter collecting underneath; and the uſual method of effecting this, is by introducing the needle from without inwards, and again from the bottom of the wound to the ſame diſtance on the oppoſite ſide. But this ſuture, it may be remarked, is much more neatly, and at the ſame time more eaſily performed, by paſſing both ends of the thread from within outwards; as may be readily done by uſing two needles upon each thread, inſtead of one. A needle being put upon each end of the ſame thread, and each needle being inſerted at the bottom of the ſore, and puſhed outwardly, ſo as to paſs out at a proper diſtance from the edge of the wound, the needles are then to be taken off, and the threads allowed to remain till all the ligatures are paſſed which the extent of the ſore ſeems to require.

The number of ligatures neceſſary for any wound, muſt in a great meaſure depend upon the extent of the divided parts. By authors, in general, it has been laid down as an eſtabliſhed rule, that one ſuture is ſufficient for every inch of wound. It will frequently, indeed, happen, that this number is ſufficient; but in ſome inſtances,

ſtances, particularly where muſcular parts are deeply cut tranſverſely, and where conſequently a great degree of retraction takes place, more ſtitches are neceſſary: Whenever a number of angles, too, occur in wounds, more ligatures are required than in ſtraight wounds of the ſame extent; for, at every angle, however inconſiderable it may be, there ought to be a ſuture.

In paſſing the ligatures the ſkin ſhould be pierced at a ſufficient diſtance from the edge of the wound: for if they do not comprehend a thickneſs of parts, in ſome meaſure proportioned to the depth of the wound, and to the extent of retraction that may take place, they will be apt to cut through the parts entirely.—By ſome, we are deſired to enter the ligatures, at a diſtance from the edges of the ſore, nearly equal to the depth of the wound. This rule, however, will not always anſwer in practice. Thus, in very deep wounds, ſuch, for inſtance, as are three inches or upwards in depth, there can be no neceſſity for carrying the ligatures three inches from the edges of the ſore; and again, in very ſuperficial cuts, it ſometimes happens that the ligatures ought to be paſſed out at a diſtance from the edges of the wound greater than its depth. It ought not, in almoſt any caſe, to be leſs than half an inch from the edge of the ſore; and it will ſeldom happen, even in the largeſt wounds, that the diſtance of an inch is not found to be ſufficient.

It will be readily underſtood, that the ſtrength of the ligatures, and ſize of the needles, ought always to be proportioned to the depth of the ſores and retraction of parts. The ſeveral ſizes of needles repreſented in Plate III. are ſuch as are found to anſwer beſt; and the ligatures to be uſed along with them ought to be ſuch as nearly, though not entirely, fill the eyes of the needles. In order to make the ligatures paſs with more eaſe, to render them more durable, and at the ſame time to make them more ſuſceptible of a flattened form, which does not ſo readily cut through the contained parts as thoſe that are round, they ought all to be well waxed.

As ſoon as the threads are all paſſed, the lips of the wound ſhould be preſſed together and ſupported by an aſſiſtant, till all the ligatures are firmly tied; beginning either in the middle of the wound, or at one end, as the operator may incline: In tying the knots, it is uſual to paſs the ends of the threads twice through the firſt nooſe; and when this is done, ſome have imagined that there is no neceſſity for more than one knot upon each ligature; but as two knots are eaſily made, and as every chance of their giving way is in this manner prevented, this precaution ſhould not be omitted. It is a practice with ſome ſurgeons to inſert a piece of lint between the firſt and ſecond knots, or between the firſt knot and the ſkin below, in order to ſave the ſkin from the preſſure of the knots; but no advantage of importance, is derived from it, while it prevents the knots from being made with ſufficient accuracy.

By ſome, we are deſired not to bring the knots of the ligatures immediately upon the edges of the wound, but rather to carry them to one ſide upon the ſound teguments: but whoever has tried both methods, will at once be ſenſible, that this is no improvement; for in no way can both ſides of the ſore be ſo equally ſupported, as when the knots are paſſed immediately above the lips of the divided parts.

SECTION III.

Of the Quilled Suture.

AS the quilled ſuture is ſtill employed by ſome practitioners, I ſhall here mention the mode of performing it.

In deep wounds, attended with much retraction, it is always neceſſary to aſſiſt the operation of the ligatures, by means of bandages ſo applied as to afford as much ſupport as poſſible to the divided parts: But, even with every aſſiſtance of this kind, it ſometimes happens, that the divided parts cannot be kept together; retraction occurs to a greater or leſſer degree, and the ligatures cut aſunder the parts that they were at firſt made to ſurround.

With a view to prevent the teguments and other parts from receding, it was long ago propoſed to add to the interrupted ſuture what was ſuppoſed would afford an additional ſupport; namely, quills, or pieces of plaſter rolled up into the form of quills; one of which being placed on each ſide of the wound, the doubling of the ligature is made to include the one, and the knot to preſs directly upon the other, inſtead of being made immediately on the edges of the ſore, as was directed for the interrupted ſuture.

It is at once evident, however, that the ligatures muſt here make the ſame degree of preſſure on the parts through which they paſs, as they do in the interrupted ſuture; and this being the caſe, it is equally obvious, that the interpoſition of theſe ſubſtances cannot be of any uſe. This ſuture is accordingly now very rarely practiſed, and it is probable that it will be ſoon laid entirely aſide.

SECTION IV.

Of the Glovers' Suture.

THIS ſuture receives its name from being that which glovers commonly uſe. As it is exceedingly ſimple, and very univerſally known, it does not here require a particular deſcription: I ſhall therefore juſt ſhortly obſerve, that it conſiſts in a ſeries of ſtitches all connected with each other, and continued in an oblique ſpiral direction along the courſe of the divided parts intended to be kept together.

This ſuture has hitherto been univerſally employed for reuniting ſuch parts of the inteſtines as have been divided by wounds: but, in treating of injuries of the inteſtines, I ſhall endeavour to ſhow, that the ſame end may be more perfectly attained, and probably with leſs danger, by means of the interrupted ſuture; ſo that as this ſuture has almoſt never been applied to any other purpoſe, it will likewiſe in all probability ſoon fall into diſuſe.

SECTION V.

Of the Twiſted Suture.

BY the term Twiſted Suture is meant that kind of ligature, by which parts, either naturally or artificially ſeparated, are united together, by means of ſtrong threads properly twiſted round pins or needles puſhed through the edges of the divided parts.

This ſuture is commonly employed for uniting the parts in the operation for the hare-lip; and this indeed is almoſt the only uſe to which it has been hitherto applied: But I may here remark, that it may with much advantage be put in practice in other caſes, particularly in all artificial or accidental diviſions of the lips or cheeks: And, in every wound in other parts that does not run deep and in which ſutures are neceſſary, this ſuture is preferable to the interrupted or any other.

In very deep wounds, for inſtance in all that extend to a greater depth than an inch, the interrupted ſuture is the only one that is admiſſible; for, in all deep cuts, the pins neceſſary in the twiſted ſuture cannot with propriety be employed, as they cannot be introduced to ſuch a depth, and afterwards ſo twiſted with ligatures as to reunite the divided parts, without exciting ſevere pain. In ſuch wounds, therefore, we muſt of neceſſity employ the interrupted ſuture. But it may here be remarked, that wounds of this depth requiring the aid of ſutures, are ſeldom met with: ſo that, in by much the greateſt proportion of wounds requiring ſutures, the twiſted ſuture may be in our power; and whenever it is ſo, it ought certainly to be preferred, as being obviouſly better calculated, even than the interrupted ſuture, for the retention of divided parts. The pins made uſe of for twiſting the threads upon, ſhould be of a flat form, ſo as not to cut the parts through which they paſs ſo readily as the ligatures employed in the interrupted ſuture; and thus we obviate one great objection to the latter; for, every practitioner muſt be ſenſible of this being the chief inconvenience of the interrupted ſuture, that when muſcular parts are divided, ſo as to produce much retraction, the ligatures employed for retaining them, almoſt conſtantly cut them through before they unite; an occurrence which the flatneſs of the pins that we employ for the twiſted ſuture, is particularly well calculated to prevent.

The pins uſed in this operation have commonly been made of ſilver; and, in order to make them paſs with more eaſe, they are made with ſteel points. As gold pins, however, are capable of receiving a ſufficient degree of ſharpneſs, which renders ſteel points unneceſſary; and as gold is more cleanly than ſilver, from its not acquiring ſo readily that kind of cruſt which immerſion in fluids is apt to produce upon the other; pins of this metal are therefore better.

The form and ſize of pins repreſented in Plate IV. are by experience found to be the beſt for every ordinary purpoſe; but for particular caſes, the ſize muſt no doubt be ſubject to ſome variety.

The manner of performing this operation is as follows: The divided parts muſt by the hands of an aſſiſtant be brought nearly into contact; leaving juſt as much ſpace between the edges of the wound, as to allow the ſurgeon to ſee that the pins are carried to a proper depth. This being done, one of the pins muſt be introduced through both ſides of the wound, by entering it on one ſide externally, puſhing it forwards and inwards to within a little of the bottom of the wound, and afterwards carrying it outwards through the oppoſite ſide, to the ſame diſtance from the edge of the ſore that it was made to enter at on the other.

The diſtance at which the needle ought to enter from the edge of the ſore, muſt depend on the depth of the wound, and degree of retraction that takes place; but whatever the deepneſs of the wound may be, the pins ſhould paſs within a very little of its bottom; otherwiſe the parts which lie deep will run a riſk of not being united, which will be very apt to give riſe to ſores or collections of matter.

In paſſing the pins through the ſides of the wound, if the ſkin and other teguments are not more firm than ordinary, it may commonly be done with the fingers alone, eſpecially if the pins are made with ſmall heads or knobs for the fingers to preſs upon; but when firmneſs of parts and other circumſtances render the entrance of the pins difficult, the inſtrument termed by the French *Porte-aiguille*, very effectually removes this inconvenience.—In Plate IV. fig. 1. is repreſented the beſt form of this inſtrument that has yet been invented.

The firſt pin being paſſed in this manner near to one end of the ſore, and the parts being ſtill ſupported by an aſſiſtant, the ſurgeon, by means of a firm waxed ligature, paſſed three or four times round and acroſs the pin, ſo as nearly to form the figure of 8, is to draw the parts through which it has paſſed into cloſe contact; and the thread being now ſecured with a looſe knot, another pin muſt be introduced in the ſame manner at a proper diſtance from the firſt; and the thread with which the other was fixed, being looſened, and in the ſame manner carried round this pin, others muſt be introduced at proper diſtances along the whole courſe of the wound, and the ſame ligature ſhould be of a ſufficient length for ſecuring the whole.

The number of pins to be uſed, muſt depend upon the extent of the wound. But whether the wound is large or of ſmall extent, a pin ſhould be inſerted near to each end of it, otherwiſe the extremities of the cut are apt to ſeparate, ſo as not to be afterwards eaſily reunited. In large wounds, the pins being introduced at the diſtance of three quarters of an inch from each other, will in general anſwer; but, in wounds of ſmaller extent, a greater number of pins are neceſſary in proportion to their dimenſions.

Thus, in a wound of an inch and half in length, three pins are requiſite; one near to each end, and another in the middle: Whereas, five pins are ſufficient for a wound of three inches and a half long, allowing one to be within a quarter of an inch of each end of the wound, and the others along the courſe of it, at the diſtance of three quarters of an inch from each other.

The pins being all introduced and ſecured in the manner I have mentioned, nothing remains to be done, but to apply a piece of lint, wet with mucilage, or ſpread with any emollient ointment, along the whole courſe of the wound, in order to exclude the external air as much as poſſible.

With the view of preventing the ends of the pins from hurting the ſkin below, it is uſual to apply a ſmall bolſter of lint under each of them; but as this always does harm, by tending to preſs the pins againſt the parts through which they have paſſed, it ought certainly to be omitted. When, however, the patient complains of being hurt by the ends of the pins, this may be eaſily prevented by introducing between them and the ſkin beneath pieces of thin linen, ſpread with adheſive plaſter.

In order to give as much chance as poſſible to this operation, it has commonly been adviſed, immediately after the pins are ſecured, to apply the uniting bandage over the whole, with the view of ſupporting the contiguous parts. The leaſt reflection, however, renders it evident, that every degree of preſſure made in this manner muſt do harm; for, the bandage being made to reſt immediately upon the pins, a conſiderable degree of pain muſt of courſe enſue from it; which happens indeed in ſuch a degree, that, in every inſtance in which I have known it employed, it either did harm, by preſſing upon the pins; or, if this did not happen, no advantage was derived from it, from its not being applied with ſuch tightneſs as to afford any ſupport to the parts below. In ſome inſtances, indeed, I have employed adheſive plaſters with obvious benefit, along with the twiſted ſuture: By applying a portion of plaſter, ſpread upon leather, between every two of the pins, we are enabled to draw the parts very forcibly together with pieces of thread or ſmall tape previouſly attached to each portion of the leather, and where the retraction of the divided muſcles is more than uſual, this precaution ſhould never be omitted: I have had recourſe to it with much advantage in the operation for the hare-lip.

We have next to conſider the length of time which the pins ſhould be allowed to remain. When they remain long, they generally do harm, by the irritation and conſequent retraction of parts, which they are apt to produce; and again, if not long enough continued, that degree of adheſion is not formed between the divided parts that is neceſſary for their retention, ſo that the effect of the operation is in a great meaſure, if not entirely, loſt.

In wounds of no great depth, I have, by experience, found, that firm adheſion takes place in the ſpace of five days; and that ſix, or at moſt ſeven days, are ſufficient for wounds of the greateſt depth.

But, in ſpeaking of this, it muſt always be underſtood, that the patient's ſtate of health will have much influence on the length of time that may be neceſſary. In ſpecifying the time required for this purpoſe, the operation is ſuppoſed to be done in a healthy ſtate of body. When the patient labours under diſeaſe it is impoſſible to aſcertain this circumſtance with preciſion: In ſuch caſes we muſt be determined by the age of the patient and ſtate of his conſtitution at the time.

As ſoon as the pins are withdrawn, the uniting bandage may be applied with much advantage as a ſupport to the parts newly united; but, as ſlips of adheſive plaſter, when applied, as I have adviſed above, to each ſide of the cicatrix, may be made to anſwer the purpoſe in a more exact manner, this mode of ſupporting the parts will in general be preferred.

As the twiſted ſuture, when properly performed, is a very neat operation; as its conſequences are in general of importance; and as it may, with much advantage, be made to ſuperſede the uſe of almoſt every other ſuture, a few inſtances only excepted, I have here judged it proper to conſider it with more attention than has hitherto been commonly beſtowed on it.

CHAPTER VII.

Of the LIGATURE *of* ARTERIES, *and other Means employed by Art for putting a ſtop to* HEMORRHAGIES.

IN every wound, whether produced by accident, or by ſurgeons in performing operations, the firſt circumſtance requiring attention, is the hemorrhagy; which may proceed either from one or more large arteries, or it may be produced by a general oozing from the ſmaller veſſels over the ſurface of the ſore.

A ſurgeon being called to a perſon loſing much blood from a large artery, the firſt ſtep to be taken, is, to put a temporary ſtop to the diſcharge, by means of preſſure, till by the application of ligatures a more effectual remedy is obtained. In the head, as well as in the trunk of the body, the eaſieſt way of effecting this is to preſs doſſils of ſoft lint or dry ſponge upon the mouths of the divided arteries, either by the hands of an aſſiſtant, or by the proper application of a bandage: Or, when preſſure can be effectually applied to the ſuperior part of the artery, it ought to be preferred; as it not only ſecures the veſſel equally well, but more readily admits of a ligature being afterwards applied to the divided part of it.

When, again, hemorrhagies take place in any of the extremities, and where preſſure can be made with eaſe on the ſuperior parts of arteries, for ſuch caſes we are in poſſeſſion of a remedy, which, when ſkilfully applied, never fails to put an immediate ſtop to all further loſs of blood: I mean the Tourniquet.

Till the invention of this inſtrument, and it was not known till the laſt century, Surgery remained extremely defective indeed. No operation of importance could be performed on any of the extremities, but with much hazard; ſo that large wounds frequently proved fatal from the want of it, which otherwiſe would have been attended with no danger.

As the invention of the Tourniquet is claimed by different perſons, and even by different nations, I ſhall not here pretend to ſay from whence it originally came: but whoever was the inventor, the firſt with which the world was made aquainted, was exceedingly ſimple; inſomuch, that we are now apt to be ſurpriſed at the diſcovery having been left to ſuch a late period. A ſmall cuſhion being placed upon the courſe of the principal artery of a limb, a circular rope or bandage was made to paſs twice round it; and a ſmall wooden handle being then introduced into one of the folds of the rope, for the purpoſe of twiſting it, the cuſhion by theſe means was preſſed with ſo much force upon the artery, as to put an effectual ſtop to the circulation in all the under part of the limb.

Mr Petit, an eminent ſurgeon of Paris, was the firſt who improved this inſtrument: He connected the circular bandage with a ſcrew, which was ſo cnotrived as to produce the preſſure chiefly on the principal arteries, without materially affecting the reſt of the limb. It had alſo this advantage over the other inſtrument, that the operator himſelf could manage it, without employing an aſſiſtant; but it was liable to one great inconvenience from the very circumſtance which, by the inventor, was conſidered as an improvement. This inſtrument of Mr Petit being made to act upon the principal arteries only, the ſmaller veſſels communicating with theſe, not being properly compreſſed, diſcharge blood freely from the inſtant they are cut; and as this proves always troubleſome in the courſe of operations, different improvements have of late been made on it. Fig. 1. Plate V. repreſents the beſt that has yet been invented.

By means of this inſtrument in its now improved ſtate, the blood is very eaſily and effectually ſtopped; and as it graſps the whole member equally, all the collateral branches, as well as the principal arteries, are equally compreſſed by it. It has alſo this material advantage over every other inſtrument of this kind, that, when properly applied, a ſingle turn, or even half a turn of the ſcrew, is ſufficient either for allowing a flow of blood, or for putting a total ſtop to it.—The manner of uſing it, is this.

Let a cuſhion, three inches in length, by one inch and half in diameter, be formed of a linen roller, tolerably firm, but yet not ſo hard as to render the preſſure produced by it painful: This being placed upon the courſe of the principal artery of the limb, let it be firmly ſecured by one or two turns of a circular roller of the ſame breadth with the cuſhion itſelf.

The inſtrument A, with the ſtrap connected with it, being now placed upon the limb, with the handle of the ſcrew B on the ſide of the member oppoſite to the cuſhion upon the artery, the ſtrap C is to be carried round the limb directly over the cuſhion, and to be firmly connected on the other ſide to the buckle D. In thus connecting the ſtrap and buckle together, it ought to be done with much firmneſs, ſo that the ſcrew may afterwards operate with as much advantage as poſſible, in producing a ſufficient degree of preſſure. When proper attention is given to this, a ſingle turn of the ſcrew proves ſufficient, as I have obſerved above, for putting a ſtop to the circulation of blood in the limb; but when the ſtrap has not been made tight at firſt, ſeveral turns of the ſcrew become neceſſary; which never fails to prove troubleſome in the courſe of an operation, and which ought therefore to be guarded againſt.

When it is therefore determined, that any further loſs of blood from a divided artery is to be prevented, preſſure on the ſuperior part of the veſſel ſhould be immediately applied, by the hands of an aſſiſtant,

ſiſtant, or by a proper bandage, when the cut is on the head or trunk of the body; and by the tourniquet in any of the extremities.

The patient being in this manner ſecured from immediate danger, the practitioner muſt endeavour to prevent a return of the hemorrhagy on the tourniquet being removed.

The ancients, as I have obſerved above, were ignorant of the uſe and application of the tourniquet, and they were equally deficient in the employment of means for giving a permanent ſecurity againſt the flow of blood from divided veſſels. It will therefore readily occur to practitioners of the preſent day, that in this imperfect ſtate of chirurgical knowledge, they muſt in all important operations have incurred much riſk of doing harm: To the ſmaller veſſels they applied doſſils of linen covered with aſtringent powders or tinctures; and for diviſions of the larger arteries, ſearing with hot irons was their only reſource.

On this laſt remedy, however, although it commands a temporary ſtoppage of the blood in every caſe of hemorrhagy, we ought not to place much dependence; for, if not carried to a greater depth than in general is conſiſtent with ſafety, the pulſation of the larger arteries very ſoon overcomes all the reſiſtance produced by the eſchar obtained from the cautery.

In ancient times, however, when this was the moſt effectual remedy with which the world was acquainted, practitioners were under the neceſſity of employing it; and, at that period, it is not ſurpriſing to find them exerciſing their genius in inventing a variety of ſtyptic applications: But ſince ſurgery became enriched with that material improvement of ſecuring the larger arteries with ligatures, a practice eaſily effected, and with very little pain to the patient, we are rather ſurpriſed to find that remedies of this claſs are ſtill ſearched after. If the uſe of ligatures were in itſelf attended with difficulty; if, by experience, it had been found to produce any dangerous conſequences; or, if it had been frequently known to fail in anſwering as a full ſecurity againſt the hemorrhagies of the largeſt arteries; in any of theſe events, it ought to be the buſineſs of practitioners to endeavour to procure a more effectual remedy. But, as the ligature of arteries is very ſimple in its nature; as the pain ariſing from it is trifling; as few inſtances occur of any thing bad being produced by it; and eſpecially as, when properly performed, it never fails to prove a ſure preventative againſt all loſs of blood from the larger arteries; there can be no good reaſon for anxiouſly ſeeking after other remedies.

Agaric, common ſponge, and other fungous ſubſtances have been much extolled for their ſtyptic powers; and chalybeate and vitriolic ſolutions, as well as all the variety of mineral acids, have in different forms been held forth to the public as effectual remedies of this nature; not only as noſtrums, by thoſe of leſs liberal principles, but, what is more ſurpriſing, in ſome inſtances by practitioners of character.

With the former claſs of men, this happens as a common occurrence in the courſe of their profeſſion, and is therefore to be expected; but a perſeverance in queſt of new ſtyptics on the part of Surgeons of reputation, who are well acquainted with the beneficial effects of ligatures, muſt proceed from a degree of nicety and refinement, which may create much trouble to themſelves, and which in all probability can never be productive of any advantage to their patients.

I may therefore venture to ſay, that it ſhould be conſidered as an eſtabliſhed maxim in ſurgery, That in hemorrhagies from the larger arteries, no ſtyptic whatever ought to be truſted, and that we ſhould place dependence only on the uſe of ligatures: I ſhall now therefore proceed to conſider the eaſieſt and moſt effectual method of putting this remedy in practice.

Various methods have been propoſed for ſecuring arteries with ligatures. The practice now in common uſe, is, by means of a curved needle, to paſs a ligature of ſufficient ſtrength round the mouth of the bleeding veſſel, including a quarter of an inch all round of the contiguous parts *, and afterwards to form a knot upon the veſſel and other parts comprehended in the nooſe.

One important objection, however, to this practice, is, that the nerves accompanying the bloodveſſels, together with a conſiderable portion of the muſcular ſubſtance through which they paſs, muſt always be tied with ligatures formed in this manner. From this circumſtance, much unneceſſary pain is produced, by the nerves and contiguous parts being compreſſed along with the arteries; and, in ſome inſtances, ſevere convulſions have ariſen from this, not only of the part chiefly affected, but of the whole ſyſtem.

Spaſmodic

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* Sharp's Surgery,—on Amputation.

Spaſmodic twitches frequently take place after the amputation of limbs, and are often the ſource of much diſtreſs. In ſome inſtances, this ſymptom is no doubt the effect of other cauſes; but in various caſes it has happened, that the cleareſt proof has been obtained of its ariſing from the ligatures of arteries applied in an improper manner. When convulſions occur after amputations, and the uſual means of preventing them are found to fail, effectual relief may be frequently obtained by undoing the ligatures, ſo as to remove the compreſſion upon the nerves; care being taken at the ſame time to renew the ligatures upon the arteries alone, without comprehending any of the contiguous parts.

Thus, it is not from the mere application of ligatures to bloodveſſels, but from the improper manner in which the operation is performed, namely, the including nerves and other parts, inſtead of tying the arteries alone, that the bad ſymptoms in ſuch caſes proceed.

Practitioners have commonly been afraid of tying arteries by themſelves, without the intervention of ſome of the ſurrounding parts: This has happened from an idea that has prevailed of the coats of bloodveſſels not being ſufficiently firm to bear a degree of compreſſion neceſſary for the prevention of hemorrhagy.

This, however, proceeds upon the ſuppoſition, of the coats of arteries not being ſo ſtrong as they really are; and that a great degree of force is neceſſary for retaining their ſides in contact.

But it is now well known, that even very ſmall arteries are poſſeſſed of much firmneſs; and it is alſo known, that even in the largeſt arteries of the arm and thigh, a very ſlight degree of compreſſion is ſufficient, not only for reſtraining hemorrhagy, but for ſecuring the ligature on the very ſpot to which it is firſt applied: In ſmall veſſels, the force neceſſary for this purpoſe is trifling indeed; being much leſs than is commonly employed.

It has alſo been objected to this mode of ſecuring bloodveſſels by themſelves, that the ligatures are more apt to ſlip than when ſome of the ſurrounding parts are tied along with them; and, in ſome inſtances, it is ſaid that arteries retract ſo far, that they cannot in any other way be laid hold of, than with the crooked needle in the ordinary method.

Long and repeated experience, however, of a few individuals, in regard to this mode of taking up arteries by themſelves, has put the fact beyond a doubt, that it is as ſecure as any other yet invented. Fatal hemorrhagies, after capital operations, either from inattention, or ſome other cauſe, ſometimes indeed happen in the hands of the moſt expert ſurgeons, but they occur more frequently when the curved needle has been employed, than when the bloodveſſels are ſecured by themſelves, without any of the contiguous parts being included.

From the reſult of my own experience, indeed, I ſhould be induced, even in this

point

point of view, to draw a concluſion in favour of the practice I recommend. For both among hoſpital patients, and in private, I have known different deaths occur from the bleeding of ſtumps after the amputation of limbs: and whether this proceeded from the ligatures having ſlipped from the arteries; or, that ſome of the veſſels which did not appear during the operation, had been of courſe paſſed over, and had afterwards burſt out; I ſhall not pretend to determine: but in all of theſe, *the crooked needle only* had been uſed during the operation; and it has ſo happened, that I never met with a ſingle inſtance of a ſimilar occurrence where the arteries were ſecured by themſelves with the tenaculum; an inſtrument to be hereafter mentioned.

In a few inſtances it may happen, that a bleeding veſſel, by lying at the bottom of a deep wound, cannot be laid hold of in any other manner than by paſſing a curved needle and ligature round it. Such occurrences, however, are ſo rare, that I have met with few inſtances in which hemorrhagy could not be as eaſily reſtrained with the tenaculum, as with the crooked needle.

In all operations whatever, to ſave unneceſſary pain, is a very important point. The object in view ought no doubt to be attained in the moſt complete manner; but that mode of operating, which is equally effectual with any other, at the ſame time that it is the leaſt painful to the patient, ought in every inſtance to be preferred. Now, with reſpect to the point in queſtion, as I have already made it appear that arteries may be tied with as much ſafety by themſelves as when connected with any of the neighbouring parts, the difference of pain ariſing from the two modes of operating, ought at once to give the preference to that which is productive of the leaſt degree of it.

When any of the contiguous parts, particularly when the nerves, which generally accompany bloodveſſels, are included in the ſame ligature with an artery, a circumſtance ſcarcely to be avoided when the curved needle is employed, a very ſevere degree of pain is often excited by tying the knot. I have known various inſtances of patients, bearing the amputation of limbs, and of cancerous breaſts, without ſhrinking, but who complained ſeverely of the pain excited by tying the arteries with the crooked needle: While, on the contrary, the pain ariſing from the uſe of the tenaculum, is ſo trifling, that, when properly done, even the moſt timid patients ſeldom complain of it.

For ſome time after I firſt made uſe of the tenaculum, curioſity induced me, in different inſtances, to put the point in queſtion to the teſt of experiment: And to render the trial fair and deciſive, it was always made upon the ſame ſubject, under the ſame operation. Different veſſels were ſecured in the ordinary manner with the crooked needle; whilſt others were laid hold of with the tenaculum: But ſo great was the difference, that the one ſeldom gave much uneaſineſs; while the patient commonly complained of the other as the moſt painful part of the whole operation.

Among other advantages attending the tying of arteries with the tenaculum, there is one which I have not mentioned: It often happens after the amputation of limbs, as well as in other operations, that the ligatures do not come eaſily away, from their being made to run ſo deep as with the curved needle is commonly neceſſary. In ſome inſtances, much pain and trouble has occurred from this, the ligature remaining immoveable, for a great many weeks: And after all, I have known it neceſſary to cut it out with a ſcalpel. But when the tenaculum is uſed, every riſk of this is avoided, as the ligatures generally drop of their own accord, in the courſe of the third or fourth dreſſing of the ſore.

I ſhall, therefore, conſider it as a practice that ſhould be eſtabliſhed, that in forming the ligature of arteries, the nerves and other contiguous parts ought to be avoided.

For the purpoſe of performing this with eaſe and ſafety, various kinds of forceps have been invented, with which the divided arteries are laid hold of and pulled out, ſo as to admit of the ligatures being applied.

For the larger bloodveſſels, forceps have been found to anſwer; but for ſmaller arteries, they are not ſo uſeful as the tenaculum, repreſented in Plate III. fig. 1. and 8. And as a hook of this form anſwers equally well in the larger arteries alſo, the uſe of forceps may therefore be laid aſide. The manner of uſing the tenaculum is this.

In order to diſcover the arteries to be tied, the tourniquet with which they are ſecured muſt be ſlackened by a turn or two of the ſcrew; and the moment the largeſt artery of the ſore is diſcovered, the ſurgeon ſhould fix his eye upon it, and immediately reſtrain the blood with the tourniquet again. A nooſe having been previouſly formed on the ligature, and paſſed upon the tenaculum, the operator ſhould now puſh the point of the inſtrument through the artery; and at the ſame time ſhould pull it out to the extent of an eighth part of an inch or thereby: The nooſe ſhould now be pulled over the point of the tenaculum by an aſſiſtant; and being preſſed ſufficiently upon the artery, a knot ſhould be formed with it of ſuch tightneſs as may be neceſſary: In forming this ligature, the Surgeon's Knot, as it is termed, ſhould be preferred: It is done by paſſing the thread twice through the firſt nooſe, and as ſome additional ſecurity is obtained by forming a ſecond knot above the firſt, it ſhould never be omitted. It is eaſily done; and on ſecurity in this point, the patient's life may in a great meaſure depend.

The ſtrength of the ligature ſhould always be proportioned to the ſize of the artery; but this is a circumſtance to be at all times determined by the judgment of the practitioner, as muſt alſo the force to be employed in forming the knots. To what was already ſaid upon this point, I ſhall here add, that a very trifling force is ſufficient for ſecuring even the largeſt arteries: and that, after ſuch a force has been applied, as evidently reſtrains the flow of blood, no further compreſſion ſhould be made.

The principal artery being in this manner ſecured, all the arteries which have been cut muſt be taken up in a ſimilar manner, by firſt looſening the tourniquet in order to diſcover them, and afterwards applying a ligature upon each.

It often happens, however, that the loſs of blood, in the courſe of an operation; a tendency to deliquium which may continue for ſome time; the fear which the patient labours under; and the degree of cold to which the ſore is expoſed; have altogether ſuch an effect upon the ſmaller arteries, as to prevent them for the time from diſcharging their contents: and as arteries left in this ſtate, without being ſecured, generally burſt out afterwards, a circumſtance which always occaſions much trouble to the practitioner, as well as pain and riſk to the patient, nothing ſhould be omitted that can in any manner of way tend to prevent it.

With this view, the tourniquet ſhould be made perfectly looſe; any coagulated blood on the ſurface of the ſore ſhould be carefully waſhed off with a ſponge and warm water; and the patient, if likely to faint, ſhould take a glaſs of wine, or ſome other cordial: and after all, the ſurgeon ought to examine, with the moſt minute attention, the courſe which the veſſels of the part uſually take.

This being done, every artery that can be diſtinguiſhed, ſhould be ſecured with a ligature; for ſuch as may ſeem to be very ſmall, while the part is yet expoſed to the air, may diſcharge large quantities of blood after the patient becomes warm in bed; when the ſolids are thereby relaxed, and the fluids expanded: and, as no harm can ariſe from ligatures being applied to every artery that is cut, it ought in every inſtance to be done.

When the principal arteries of a ſtump have been taken up, and blood ſtill continues to be diſcharged, but which appears to come from a few ſmall veſſels only, the ſurgeon, unleſs he is much accuſtomed to this kind of buſineſs, is apt to think, from their trifling appearance, that he need not be at the trouble of tying them, and that the preſſure of the neceſſary bandages will prove ſufficient: Where the diſcharge proceeds from the whole ſurface of a wound, and when no particular veſſel can be diſtinguiſhed, we muſt of neceſſity truſt to this remedy; but, whenever an artery can be diſcovered, of whatever ſize it may be, it ought unqueſtionably to be ſecured with a ligature. I have inſiſted the more upon this, from having often obſerved both diſtreſs and danger induced, by want of attention to this part of an operation, and from ſome late publications having very improperly endeavoured to ſhew, that there is no riſk in leaving all the ſmall arteries untied that are cut in operations; a practice fraught with much perplexity to practitioners, and with the utmoſt hazard to patients.

When, from the deepneſs of a wound, or from any other cauſe, ſome particular artery cannot be properly ſecured with the tenaculum; we are under the neceſſity, as I have already obſerved, of truſting to the crooked needle, and the following is the mode of uſing it.

The operator ſhould be provided with needles of various ſizes, and of different forms. The needles in ordinary uſe, are for many purpoſes too much crooked; for, in general, they are more eaſily managed when their curvatures are leſs.

The needles that I have mentioned for the interrupted ſuture, repreſented in Plate III., anſwer equally well for the ligature of arteries.

Thoſe in common uſe are made with three edges, one on each ſide, and a third on the concave part of the needle. There is no neceſſity, however, for more than two. Needles enter, indeed, more eaſily with two than with three edges; and as the third edge on the concave ſide, renders them liable to injure arteries and other parts in the courſe of their introduction, it ought to be omitted.

A needle of this ſhape, armed with a ligature of a ſize proportioned to itſelf, and to the veſſel to be taken up, is to be introduced at the diſtance of a ſixth or eighth part of an inch from the artery; and being carried at leaſt one-half round the artery, at a depth ſufficient for retaining it, it muſt now be drawn out; and being again puſhed forward, till it has completely encircled the artery, it is again to be pulled out, and a knot tied in the manner that I have adviſed in uſing the tenaculum.

In this manner, either by the uſe of the crooked needle, or the tenaculum, every hemorrhagy ariſing from the diviſion of one or more arteries, may in general be reſtrained; but it frequently happens, that conſiderable quantities of blood are diſcharged, not from any particular veſſel, but from all the ſmall arteries over the ſurface

face of a wound: In wounds of great extent, particularly after the extirpation of cancerous breaſts, and in other operations where extenſive ſores are left, this kind of hemorrhagy often proves troubleſome, from being very difficult to ſuppreſs.

Hemorrhagies of this kind ſeem evidently to proceed from two very different and oppoſite cauſes; which, in the method of cure, require particular attention.

FIRST, They ſometimes take place in very robuſt conſtitutions, and proceed either from too great a quantity of blood in the arteries and veins, or from an exceſs of tone in the veſſels themſelves; or, perhaps, from both of theſe cauſes being combined. But, SECONDLY, They appear to happen moſt frequently in conſtitutions quite the reverſe of this, namely, in ſuch as are weak and relaxed, either from a putrid diſſolved ſtate of the blood, from want of tone in the veſſels, or in ſome inſtances from a concurrence of both.

In healthy patients, when the fluids are not tainted with putreſcency, and the ſolids are poſſeſſed of their natural tone, as ſoon as the large arteries of a wound are ſecured, the ſmaller veſſels for the moſt part recede within the ſurface of the ſurrounding parts: This they do in conſequence of that contractile power with which, in a ſtate of health, they are endowed, and from the ſtimulus of the external air to which they are now expoſed. This of itſelf would often prove ſufficient for reſtraining hemorrhagies from ſmall arteries; but in the ſound ſtate of conſtitution to which I allude, another powerful agent is provided for producing the ſame effect. From the extremities of the divided veſſels which at firſt diſcharged red blood, there now, in their contracted ſtate, oozes out a viſcid fluid, containing a certain proportion of the coagulable part of the blood; and this on ſpreading over the ſurface of wounds, has, by its balſamic agglutinating powers, a very conſiderable effect in reſtraining the hemorrhagy.

Where the conſtitution is ſound, and where neither of theſe ſtates of diſeaſe preponderates over the other, it is obſerved, as ſoon as the larger arteries of wounds are ſecured, that nature, in the manner I have deſcribed, generally puts a ſtop to all further diſcharge. So that when this does not happen, and when a tedious oozing continues from the ſurface of a ſore, we ought to pay particular attention to the habit of body with which it is combined.

In young vigorous patients, where the tone of the muſcular fibres is conſiderable, the moſt effectual means of putting a ſtop to this variety of hemorrhagy, is to relax the vaſcular ſyſtem, either by opening a vein in ſome other part, or by undoing the ligature on one of the principal arteries that have been tied, ſo as to allow it to bleed freely: Thoſe violent ſpaſmodic twitchings, too, ſo frequent after the amputation of limbs, when they do not depend on a nerve being tied in the ligature with the artery, are in this manner more effectually relieved than by any other means.

By the ſame means, the patient from being in a febrile heat and much confuſed, ſoon becomes tranquil: The violent pulſation of the heart and larger arteries abates, and the blood not being propelled with ſuch impetuoſity, the ſmaller veſſels of the part are thereby left at more liberty to retract; and as in this ſtate they do not pour forth red blood ſo freely, they are the more readily covered with that viſcid glutinous fluid which I have already ſhewn to be one of the moſt important means provided by nature for the cure of hemorrhagies.

At the ſame time that we thus endeavour to allay the commotion produced in the ſyſtem, the patient ſhould be kept exceedingly cool; wine and other cordials ſhould be avoided; cold water, acidulated either with the mineral or vegetable acids, ſhould be his only drink; motion of every kind ſhould be guarded againſt; and the wound being covered with ſoft lint, moderate preſſure ſhould be applied over the whole ſurface of the ſore with a proper bandage.

In every extenſive wound, attended with this kind of hemorrhagy, and particularly when violent ſpaſmodic affections of the muſcles ſupervene, together with the means that I have mentioned, large doſes of opiates often prove uſeful: by allaying irritation and pain, they often prove more beneficial than any other remedy.

As ſoon, therefore, as a ſufficient quantity of blood has been diſcharged, and the wound is dreſſed, and the patient laid to reſt, a doſe of opium, proportioned to the violence of the ſymptoms, ſhould be given. It muſt, however, be remarked, that in all ſuch circumſtances, opiates ſhould be given in large doſes, otherwiſe, inſtead of anſwering any good purpoſe, they ſeem frequently rather to do harm; ſo that, whenever opium is employed, it ought to be in ſuch quantities as may be ſufficient for the intended effect.

Although this kind of hemorrhagy ſometimes occurs in firm conſtitutions, yet it is certainly more frequent in relaxed enfeebled habits, where the ſolids have loſt part of their natural ſtrength, and the fluids have acquired ſome degree of putreſcency. As the veſſels in this ſituation are ſuppoſed to be deprived of that degree of tone of which we wiſh them to be poſſeſſed, inſtead of reſtraining the patient from cordials, as is uſually done in caſes of hemorrhagy, a moderate uſe of wine ſhould be preſcribed; for nothing tends ſo much in ſuch circumſtances to reſtrain hemorrhagies, as a well-directed uſe of cordials. By tending to invigorate and brace the ſolids, they enable the arterial ſyſtem to give a due reſiſtance to the contained fluids, while the ſame cauſe has no inconſiderable effect in reſtoring to the fluids that viſcidity of which in all ſuch inſtances we ſuppoſe them to be deprived.

When, therefore, tedious hemorrhagies occur in relaxed debilitated habits, a free uſe of Port, Madeira, or any other wine equally good, ſhould be allowed; a nouriſhing diet alſo becomes proper; the patient ſhould be kept cool: and the mineral acids, from their known utility in every kind of hemorrhagy, ought alſo to be preſcribed. Reſt of body is likewiſe proper; and opiates, when indicated either by pain or ſpaſmodic affections of the muſcles, ought never to be omitted.

Together with remedies of this kind, particular dreſſings, appropriated to the ſtate of the injured parts, ſhould be applied. I have already remarked, that in firm healthy conſtitutions, as ſoon as the diſcharge of blood which naturally occurs in large wounds is over, the parts come ſoon to be covered with a viſcid coagulable effuſion from the mouths of the retracted arteries; but in conſtitutions of an oppoſite nature, where the ſolids are much relaxed, the blood in general is in ſuch a diſſolved ſtate as to afford no ſecretion of this kind.

In order to ſupply as much as poſſible the deficiency of this natural balſam, different artificial applications have been employed. Covering the parts with ſtarch or wheat-flour has ſometimes proved uſeful; and I have known gum arabic, myrrh, and galbanum, in fine powder, prove ſucceſsful when theſe have failed.

Applications of this kind, indeed, have been uſed with ſucceſs in all ſuch hemorrhagies, with whatever habit of body they are combined; but they prove more particularly uſeful in relaxed conſtitutions, attended with a diſſolved ſtate of the blood, and an unfeebled muſcular ſyſtem. We may here alſo uſe a remedy which in circumſtances of this kind very ſeldom fails; but which, in thoſe of an oppoſite nature, ought never to be employed. The remedy to which I allude is alcohol, or any other ardent ſpirit, impregnated with as great a quantity as it can diſſolve, of myrrh, or any other of the heating viſcid gums. The balſamum traumaticum of the ſhops, a remedy of this kind, has long been famed for its influence in ſuch caſes; but the indiſcriminate uſe of this, and remedies of a ſimilar nature, which has long prevailed with ſome practitioners, I am confident has done much harm; for, as they all act as ſtimulants, they of courſe tend to aggravate every ſymptom in wounds connected with tenſe fibres, when much pain, and eſpecially when ſpaſmodic muſcular affections prevail. But, in conſtitutions of an oppoſite nature, where the blood appears to be in a diſſolved ſtate, and the arterial ſyſtem ſeems evidently to require a ſtimulus, remedies of this claſs prove highly uſeful: Inſomuch that where the hemorrhagies in ſuch conſtitutions prove diſtreſsful, no remedy anſwers better than lint, immerſed in a balſam of this kind.

By due perſeverance in this mode of treatment, hemorrhagies of this kind will for the moſt part be ſoon reſtrained: But when this does not happen, and when, notwithſtanding of theſe, a diſcharge of blood ſtill continues; together with the means that I have adviſed, an equal moderate preſſure ſhould be applied over the whole ſurface of the ſore, and continued as long as the neceſſity of the caſe may indicate.

In finiſhing the dreſſings of wounds of this claſs, after the lint and compreſſes have been applied, a bandage ſhould be adapted to the part in ſuch a manner as to produce an equal preſſure over the whole ſurface of the ſore. But it ſometimes happens, that no bandage can be made to produce the deſired effect: In ſuch caſes, the hand of an aſſiſtant is our beſt reſource. The hand being firmly applied over the dreſſings, ſo as to produce an equal preſſure, will commonly ſucceed when no other remedy has any effect.

Having thus endeavoured to point out the moſt effectual means of putting a ſtop to hemorrhagies, we ſhall now proceed to conſider the different modes employed by art for effecting a diſcharge of blood when indicated by the exiſtence of ſome diſeaſe in the conſtitution.

CHAPTER VIII.

OF BLOOD-LETTING.

SECTION I.

Of Blood-letting in general.

BLOOD-LETTING, whether we conſider it as to its influence on the ſyſtem, or with reſpect to the nicety with which it ought to be performed, is perhaps one of the moſt important operations in ſurgery. From being ſo frequently practiſed, and every pretender to knowledge in the healing art being able to perform it, the public have been induced to conſider it as trivial with reſpect to its execution; but every practitioner of character will acknowledge, that, in order to perform it properly, the greateſt nicety, ſteadineſs, and accuracy, are required. Every other operation in ſurgery I have frequently ſeen well performed; but I have ſeldom ſeen blood-letting with the lancet correctly done. When properly performed, it is a neat operation; but when not done with exactneſs, it is the very reverſe.

I do not here mean to conſider the various cauſes which in different circumſtances point out the propriety of abſtracting blood from the ſyſtem; nor do I intend to enter upon a particular diſcuſſion of the different effects of general and topical blood-letting: Theſe conſiderations, as being highly important, would of themſelves extend to a great length, ſo that they will not be looked for in a ſyſtem of ſurgery. All that is here intended, is to deſcribe the various modes of performing the operation of blood-letting.

In all inflammatory diſeaſes not entirely local, the method of taking away blood, as eſtabliſhed by immemorial practice, is, by ſuch means as diſcharge the quantity to be taken, at an opening made with a lancet, either in an artery or a vein. Whether there is any real difference in the effects which theſe two modes of diſcharging blood produce, it may be difficult, with preciſion, to determine; but there is reaſon to think, that, independent of the quantity taken, the difference is of leſs importance than is commonly imagined. The latter of theſe termed Phlebotomy, and the former Arteriotomy, are the means employed for what we term General blood-letting; the particular conſideration of which we ſhall preſently enter upon.

But it often happens in local inflammation, that little benefit is derived from general blood-letting, while conſiderable advantage is obtained from what we term Topical or Local blood-letting in which blood is diſcharged from the diſeaſed part, by dividing a number of the ſmall veſſels by which it is ſupplied. The means employed for this I ſhall hereafter point out, while, in the mean time, we proceed to conſider phlebotomy.

Wherever a vein can be reached with ſafety, an opening for the diſcharge of blood may be made in it with a lancet; but the following are the parts from whence blood is uſually taken in this manner; the veins of the arm at the flexure of the cubitus; the jugular veins; and the veins of the ankles and feet. In particular inſtances, blood is alſo adviſed to be taken from the veins of the hand, of the tongue, and of the eyes, and penis, as well as other parts.

Some general obſervations relate equally to this operation in whatever part of the body it is practiſed; theſe I ſhall in the firſt place point out, and ſhall afterwards proceed to treat particularly of blood-letting in the arm and other parts.

I. In this as in every operation, the poſture of the patient, as well as of the operator, merits particular attention, and it ought to be different, according to the effects that we wiſh to reſult from it.

In ſome diſeaſes, it is the object of this remedy, to diſcharge a large quantity of blood without inducing fainting: When this is the caſe, and when from former experience it is known that the patient is liable to faint during the evacuation, a horizontal poſture, either upon a bed or on a couch, ſhould be adviſed, for every practitioner knows that fainting does not ſo readily take place in a horizontal poſture, as when the patient is erect.

It ſometimes, however, happens, that one material advantage expected from blood-letting, is its inducing a ſtate of deliquium; as is the caſe in ſtrangulated hernia, where a general relaxed ſtate of the ſyſtem proves ſometimes uſeful. In all ſuch circumſtances, inſtead of a horizontal poſture, the more erect the patient is kept, the more readily will fainting be induced. So that the particular object in view from the operation, muſt at all times determine this matter.

While we thus attend to the poſture of the body, the particular poſition of the limb or part to be operated upon, muſt not be overlooked. In every operation, it is a point of importance, to have the patient ſeated in a proper light, but in none is it more material than in blood-letting. The beſt general rule that can be given for it, is, that the patient ſhould be ſo placed, that the principal light of the apartment ſhall fall directly on the part to be operated upon, ſo that the vein to be opened may be made as apparent as poſſible. When clear day-light can be obtained, it ought to be preferred; but when this cannot be procured, one or more candles ſhould be uſed.

But, whatever may be the poſition of the part itſelf, and whether the patient is placed on a bed or a chair, the ſurgeon ſhould always be ſeated. The operation may, no doubt, be done while the ſurgeon is ſtanding: and it is perhaps moſt frequently performed in this manner: but it can never be done either with ſuch ſteadineſs or neatneſs, as when the operator is firmly ſeated.

II. From the coats of veins being more flaccid than thoſe of arteries, and from the circulation which takes place in veins being ſlow, an opening made in a vein will not diſcharge freely if the vein be not cut entirely acroſs, unleſs the blood is ſtopped in its return to the heart by means of a ligature placed between the heart and that part of the vein in which the opening is made.

The patient being properly ſeated, our next ſtep therefore is, by means of a proper bandage, ſo to compreſs the vein intended to be opened, as to prevent the blood from returning to the heart; and for the ſame reaſon, an equal degree of preſſure, it is obvious, ſhould be applied to all the other veins of the part; for, were this to be neglected, the communication preſerved by the collateral branches would render the preſſure upon any particular vein of little importance. But, beſides producing a more free diſcharge of blood than could be otherwiſe obtained, this preſſure upon the veins, by cauſing an accumulation of their contents, tends to bring them more obviouſly into view, and conſequently renders it eaſier for the ſurgeon to make a proper opening than might otherwiſe be in his power.

Although compreſſion, however, to a certain extent, is neceſſary for the purpoſes of accumulating blood in the veins, and for afterwards diſcharging it at an opening made by the lancet, it is at the ſame time obvious that any conſiderable degree of preſſure, inſtead of forwarding theſe purpoſes, would obſtruct them entirely; for, if the preſſure meant to be applied to the veins only, ſhould be carried ſo far as to affect the arteries, all farther acceſs of blood to the veins would be cut off, ſo that no diſcharge of importance would take place at any opening that could be made. Whenever we mean, therefore, to diſcharge blood in this manner, the preſſure ought to be moderate: It ſhould always be carried ſo far as effectually to compreſs the veins, but never to ſuch a length as to obſtruct the circulation in the correſponding arteries. When we ſee that the preſſure raiſes the veins more conſpicuouſly into view, and if at the ſame time the pulſation of the artery is diſtinctly felt in the inferior part of the limb, we may then be ſure of its being applied in a very proper degree, and that it ſhould not be carried farther: For by the ſwelling of the veins we are ſure that they are ſufficiently compreſſed; and by the arteries continuing to beat, it is evident that a continued flow of blood paſſes into them.

III. The reflux of blood to the heart being in this manner cut off, we have next to advert to the beſt method of opening the vein. Different inſtruments have been invented for this purpoſe, but two only have been retained in uſe. Theſe are, the Lancet and Phleme. This laſt, on being placed immediately on the part to be cut, is, by means of a ſpring, ſtruck ſuddenly into the vein, and forms an opening of the exact ſize of the inſtrument.

The phleme, in various parts of Germany, has acquired ſome reputation, particularly in taking blood from the jugular veins: But various objections occur to it, ſo that it is not likely ever to be in general uſe: From the nature of the inſtrument, the deepneſs to which it ſhould go, ought to be regulated before making uſe of it: Now, we know well that this can never be aſcertained; for we frequently find it neceſſary, after the introduction of a lancet, to go much deeper than was at firſt ſuppoſed to be requiſite; ſo that when a phleme is uſed, unleſs we employ one in every inſtance of a length which cannot be frequently required, diſappointments muſt often take place.

But the moſt material objection to this inſtrument is, that where arteries or tendons lie beneath the veins, and in danger of being hurt in the operation, the riſk is much greater with the phleme than with the lancet: For when the lancet is uſed, after the vein is opened, the orifice may be enlarged at pleaſure without any additional riſk, merely by carrying the inſtrument forward along the courſe of the vein, at the ſame depth to which it was at firſt introduced; whereas the phleme, after entering the vein, muſt paſs directly down to its full depth; which adds greatly to the riſk of wounding the parts underneath.

Beſides, in uſing a lancet, we have it more in our power to command an orifice of a determined ſize, than with the phleme: So that, without heſitation, we may venture to pronounce the phleme to be an inſtrument in no degree neceſſary; but, for ſuch as incline to uſe it, the moſt convenient form of one is repreſented in Plate VI. fig. 4.

The manner of uſing the phleme is this. The bandage for producing the turgeſcency of the veins being applied in the manner already directed, the point of the inſtrument *A*, with the ſpring properly bent, muſt be ſo placed upon the part of the vein to be opened, that an orifice of an oblique direction may be made in it on the ſpring *B* being let looſe. The ſubſequent management is the ſame here as when the lancet is uſed, and will be preſently pointed out.

In uſing the lancet, the form of the inſtrument is a point of the firſt importance, although it ſeldom meets with that attention which it merits: The form of lancet in ordinary uſe, repreſented in Plate VI. fig. 3. ſhould never be employed in blood-letting: It is well calculated for opening abſceſſes; but it ought never to be uſed in this nice operation.

The moſt obvious objection to this form of lancet is, that the broadneſs of its ſhoulders makes a wound in the external teguments, perhaps three times the ſize of the opening made in the vein; which adds no advantage to the operation; while it gives much unneceſſary pain in the firſt inſtance, at the ſame time that it often renders it difficult to ſtop the flow of blood: I may alſo mention, that the wounds made by it are ſo extenſive, that they are apt to terminate in partial ſuppurations, which always prove both diſagreeable and painful to the patient.

The ſpear-pointed lancet, repreſented in Plate VI. fig. 1. and 2. is an inſtrument well calculated for the purpoſe of venæſection. From the acuteneſs of its point, it enters the vein eaſily, a circumſtance of no ſmall importance with many: It makes the opening in the vein nearly equal to the orifice in the teguments; and the diſcharge of blood at an opening made with one of theſe lancets, is commonly ſtopped with eaſe, immediately on the ligature being removed.

For theſe reaſons, the ſpear-pointed lancet ſhould be preferred; and although, with timid practitioners, the acute point of this inſtrument may appear to render more dexterity neceſſary in uſing it than the broad-ſhouldered lancet; yet the difference in this reſpect is ſo inconſiderable, that all who give it a fair trial will ſoon be able to uſe it with equal freedom. Indeed no ſurgeon ought to be truſted in letting blood with the one, whoſe ſteadineſs and dexterity would in any degree be doubted with the other.

IV. The form of lancet being thus fixed on, we come now to ſpeak of the method of uſing it. The ſurgeon and patient being both properly ſeated, and the ligature applied, that vein ſhould be made choice of, which, while it appears ſufficiently conſpicuous, is not ſo looſe as to roll, on being compreſſed: Some veins, although they riſe ſufficiently, yet roll ſo much, that they are more difficult to open than others which lie at a greater depth. That vein, therefore, is to be preferred, which not only riſes, ſo as to become obvious, but which appears to be connected with ſome degree of firmneſs to the contiguous parts. It is ſcarcely neceſſary to obſerve, when a vein appears to be ſo immediately connected with a contiguous artery or tendon, that there muſt be ſome riſk of injuring theſe parts in the operation, if another vein not liable to ſuch hazard can be procured, it ought undoubtedly to be preferred.

Veins may lie directly above both arteries and tendons, and yet no manner of riſk be incurred in opening them, provided the operator is ſufficiently ſteady and attentive; but it muſt be admitted, that in ſome inſtances veins are ſo nearly and intimately connected with theſe parts, as to render it hazardous even for the moſt dexterous ſurgeon to attempt this operation.

The vein being at laſt made choice of, the ſurgeon, if he is to uſe his right-hand in the operation, muſt take a firm hold of the member from whence the blood is to be drawn, with his left, and, with the thumb of the ſame hand, he muſt now make ſuch a degree of preſſure upon the vein, an inch and half or two inches below the ligature, as not only to render the ſkin, and teguments tenſe, but at the ſame time to interrupt all communication between the under part of the vein, and that portion of it lying between the ligature and thumb placed as thus directed.

The lancet being bent to ſomewhat more than a right angle, the operator muſt now take it between the finger and thumb of his right-hand; and, leaving at leaſt one-half of the blade uncovered, muſt reſt his hand on the middle finger, ring finger, and little finger, all placed as eaſily as poſſible near to the vein from whence the blood is to be taken; and having puſhed the point of the inſtrument freely through the ſkin and teguments into the vein, he muſt now carry it forward in an oblique direction, till the orifice is of a proper ſize; taking care, during the time of puſhing on the lancet, that the point of it be kept in as ſtraight a direction as poſſible, to prevent it from injuring the parts below.

The inſtrument is now to be withdrawn; and the ſurgeon removing the thumb of his left hand, the vein muſt be allowed to empty itſelf freely into cups provided for the purpoſe.

It is here of importance to obſerve, that the limb ſhould be kept ſteadily in the ſame poſture during the whole time that the blood is flowing off; otherwiſe, the orifice in the ſkin is apt to ſlip over the opening in the vein; a circumſtance which always proves inconvenient, and in ſome inſtances exceedingly troubleſome, by the blood from the vein paſſing into the ſurrounding cellular ſubſtance.

In taking hold of the lancet, I have directed the ſcales to form rather an acute angle with the blade of the inſtrument. It will even anſwer when they are more widely ſeparated; but a farther ſeparation proves always troubleſome, by throwing the ſcales too much back upon the hand of the operator.

The length of inſtrument that ought to project before the finger and thumb, is another circumſtance requiring attention; for unleſs a ſufficient quantity is left uncovered, the ſurgeon cannot act with freedom. In lancets of an ordinary length, one half of the blade, as I have mentioned already, ſhould always be left out.

The entry of the lancet into the vein is the next circumſtance deſerving notice; and it is readily diſcovered; for as ſoon as the point has entered the vein, the reſiſtance to its farther progreſs is immediately diminiſhed, and as ſoon as the opening is in any degree enlarged, the blood begins to ruſh out, and thus gives the cleareſt proof of this part of the operation being complete. On being thus rendered ſure that the lancet has got into the vein, I have alſo deſired that it may be carried forward in an oblique direction, taking care to keep the point of it in the ſame elevation from the inſtant it has paſſed fairly through the coats of the vein; and to this part of the operation the moſt particular attention is required. To the want of caution in this important point, much of the riſk attending this operation may be aſſigned.

The propriety of an oblique direction for the courſe of the orifice is obvious:

For, when quite longitudinal, the ſides of the wound are apt to cloſe, ſo as not to admit of a free diſcharge; while, on the other hand, when the vein is cut entirely acroſs, troubleſome conſequences commonly enſue from the wound being difficult to heal: An orifice ſomewhat oblique with reſpect to the courſe of the vein, is therefore preferable to either. But the material circumſtance to be kept in view, is the direction of the point of the lancet after it has got fairly into the vein. By almoſt every author who has written on blood-letting, as ſoon as the lancet has got into the vein, in order to extend the orifice to a ſufficient length, we are directed, very properly, to carry the inſtrument forward: But in what manner are we deſired to do ſo? By raiſing the heel of the lancet, as it is termed, at the ſame time that the point and edge of it is in ſome degree puſhed forward, ſo as to make the point of the inſtrument the centre of motion.

The reaſon of this laſt direction is, that the internal orifice of the vein may not be farther extended upwards than the external wound in the ſkin and other integuments; ecchymoſes, or effuſions of blood into the cellular ſubſtance, being the frequent effect of a different management when broad ſhouldered lancets are uſed: But when the ſpear-pointed lancet is uſed, this may be always avoided; as, from the narrow point of the inſtrument, it may with ſafety be carried on in the cavity of the vein as far as is neceſſary. When the operation is properly done, the orifice in the vein muſt be nearly of the ſame extent as the wound in the ſkin; and by the ſame management we avoid that important riſk which muſt always occur from an implicit obedience to the direction I have mentioned: for one certain effect of raiſing the heel, or back part of the lancet, is, that the point muſt in the ſame proportion be depreſſed; and the conſequence of lowering the point, already perhaps ſliding along the under ſide of the vein, muſt in all ſuch circumſtances prove extremely hazardous: For if, in this ſituation, the point of the inſtrument is depreſſed, which muſt undoubtedly happen when the heel is elevated, it muſt for certain paſs through the back-part of the vein; ſo that if either an artery, nerve, or tendon, lie contiguous, they muſt of neceſſity be wounded; and I am perfectly convinced, that this alone has often been the origin both of wounds in the arteries, and of pricks in the nerves and tendons. This practice, therefore, as being highly dangerous, ought in every inſtance to be laid aſide.

The ſize of the orifice in blood-letting ſhould at all times depend on the nature of the diſeaſe for which the evacuation is preſcribed. When it is meant to diſcharge a large quantity of blood ſuddenly, either with a view to excite fainting, or for any other cauſe, the orifice ought to be large; but in common practice, no neceſſity occurs for this.

In uſing a ſpear-pointed lancet, an orifice of an eighth part of an inch in length will in general anſwer every purpoſe; but when a broad-ſhouldered lancet is uſed, an opening of twice that ſize becomes neceſſary; for with this inſtrument the orifice in the vein will ſeldom be more than half the extent of that in the ſkin.

After withdrawing the lancet, I have deſired that the thumb of the left-hand ſhould be removed from the ſpot on which it was placed: It may perhaps appear that ſome circumſtances are here pointed out, with unneceſſary minuteneſs, and this among others may poſſibly be conſidered as one: But it muſt be remembered, that the whole of this work is chiefly meant for beginners, to whom every circumſtance in operations of importance ought to be explained: Now, one material uſe of the thumb placed below the point where the lancet enters, is, to keep the parts firm, ſo as to prevent the vein from rolling. But another advantage derived from it is, that by making a ſufficient degree of preſſure upon the vein, it prevents any blood from eſcaping between the time of removing the lancet, and the application of a cup for receiving the blood. During this period a good deal of blood is often diſcharged, to the great annoyance both of the patient, the operator, and byſtanders; a circumſtance which, with due attention, may very commonly be prevented.

V. When the vein is properly cut, and the orifice made ſufficiently large, there is ſeldom any difficulty in procuring all the blood that is wanted. But we are in ſome caſes diſappointed in this, either from the orifice of the ſkin having receded from the opening in the vein, or from the patient having become faintiſh; circumſtances always unfavourable to a free diſcharge of blood. When it happens from fainting, a ſtream of freſh air ſhould be admitted to the apartment, wine or ſome other cordial ſhould be adminiſtered, and the patient ſhould be placed in a horizontal poſture. By theſe means he will in general ſoon recover; but if ſtill the blood ſhould not flow freely, the member ſhould be placed in every variety of poſture that may tend to bring the opening in the ſkin to correſpond with that of the vein, which will ſoon be known to have happened by the blood beginning to flow. Throwing the muſcles of the part into conſtant action, by giving the patient a cane, or any other firm ſubſtance, to turn frequently round in his hand when the operation is done in the arm, will often excite a conſtant flow of blood from a vein, when all other means have failed: And, laſtly, when the pulſe in the inferior part of the member is feeble, and cannot be eaſily diſtinguiſhed, we may judge that the ligature is too tight, and may have it in our power to excite an immediate flow of blood, by removing or leſſening the compreſſion thus improperly made upon the arteries.

VI. A quantity of blood proportioned to the circumſtances of the caſe, being thus diſcharged, the preſſure upon the ſuperior part of the vein ſhould be removed; and this being done, if the ſpear-pointed lancet has been uſed, all further diſcharge of blood will in general ſtop. It ſometimes, however, happens, that the blood continues to flow freely even after the ligature is removed. When this is the caſe, the operator ſhould compreſs the vein both above and below the orifice with the finger and thumb of one hand, ſo as to prevent any farther loſs of blood: This being done, the limb ſhould be waſhed, and entirely cleared of blood: The orifice muſt alſo be cleared of every particle of blood, and the ſides of it being laid exactly together, a piece of court-plaſter, or any other that is ſufficiently adheſive, ſhould be ſo applied as to retain them. This will in many inſtances render a bandage unneceſſary; but when the blood has iſſued with much violence during the operation, and has been difficult to ſtop after the removal of the ligature, in ſuch inſtances it is right to apply a ſmall compreſs of linen over the plaſter, and to ſecure the whole with a roller round the limb.

Before applying the plaſter, I have directed the orifice to be cleared of every particle of blood; a circumſtance, I may remark, of more importance than is commonly imagined: By inattention to this point, and want of exactneſs in cloſing the orifice, painful ſwellings and conſequent ſuppurations are often induced, which with eaſe might be prevented. When the operation is properly done, the wound heals by what ſurgeons call the Firſt Intention, that is, by the parts adhering without the formation of matter; but this can ſeldom happen, if the lips of the ſore have not been neatly laid together after all the blood has been cleared away.

There is ſtill another important argument for neatneſs in this matter. Among other troubleſome conſequences ariſing from blood-letting, inflammation ſometimes occurs in the cavity of the vein; and as nothing tends more to produce this than the admiſſion of air, this circumſtance of itſelf ſtrongly points out the propriety of attention to the point in queſtion. For although inflammation in the internal ſurfaces of veins is not frequent, yet in various inſtances it is met with; and as the conſequences ariſing from it, if ſuppuration enſues, muſt commonly prove fatal, they ought in every inſtance to be ſtrictly guarded againſt.

VII. We come now to treat more particularly of ſome troubleſome conſequences which occaſionally proceed from blood-letting, and which every operator ought to be as much as poſſible prepared to obviate. The moſt material of theſe are, tumors produced by blood effuſed from the orifice of the vein into the ſurrounding cellular ſubſtance; wounds of the artery lying contiguous to the vein; pricks of the nerves and tendons; and laſtly, inflammation, induced in the internal cavity of the vein, as has juſt been mentioned. Theſe we ſhall, under ſeparate heads, proceed to conſider *.

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* Among other reaſons which I have given for preferring a ſpear-pointed lancet, it was obſerved, that with it the operation is done with leſs pain than with the broad-ſhouldered lancet: And the prevention of pain is of ſuch importance, that nothing ſhould be omitted that can in any degree tend to inſure it.

SECTION II.

Of a Thrombus, or Ecchymoſis.

I Have already deſired, that in blood-letting, the member ſhould be retained in the ſame poſture, till the whole quantity of blood intended to be taken is diſcharged.

In every operation our inſtruments ſhould be in the moſt complete order; but in none is this of more importance than in blood-letting. Well-tempered lancets will anſwer tolerably well after being frequently uſed; inſomuch that I have heard even well-employed ſurgeons aſſert, that they have uſed one or two lancets only during the courſe of many years' practice, without their ever being in the hands of a cutler. But it is certain, that every time a lancet is uſed, it muſt be more or leſs injured; and as the prevention of pain is with moſt patients a point of no ſmall importance, I think it ought to be laid down as a rule not to be departed from, never to uſe the ſame lancet twice, without putting it into the hands of a cutler. This I have long been in the practice of doing, not only with lancets, but with every cutting inſtrument; and the trouble and expence attending it is inconſiderable, when compared with the advantage derived from it.

charged. When this is neglected, a ſmall tumor is apt to form immediately above the orifice in the vein, by the blood inſinuating into the cellular ſubſtance of the neighbouring parts. This kind of tumor, when round and ſmall, is termed a Thrombus; and when more diffuſed, an Ecchymoſis.

Immediately on the appearance of theſe ſwellings, the ligature ſhould be removed; and the member being put into that poſture in which it was held when the lancet was introduced, the ligature may be again renewed. A free return of blood will probably in this manner be induced; by which, if the tumor be not entirely removed, it will at leaſt be prevented from becoming larger.

It ſometimes, however, happens, that theſe ſwellings come at once to ſuch a ſize, as entirely to preclude every poſſibility of finiſhing the operation at the orifice firſt made in the vein. Even here, however, the ligature ſhould be immediately removed as the moſt effectual method of preventing

venting an increaſe of the tumor. By continuing the bandage on the vein, as is often done, the blood ſtill continues to be forced into the ſurrounding cellular ſubſtance; by which, ſuch degrees of ſwelling are induced as are apt to create a good deal of trouble, which, with due attention, might, in every inſtance, be prevented.

In this ſituation, it would be vain to expect any conſiderable quantity of blood from the orifice firſt made. The only way in which the operation can be completed, is by making another opening, not in the ſame vein, which in ſuch circumſtances would ſeldom bleed freely, but in any other that lies moſt convenient.

When theſe tumors do not become large, they are for the moſt part eaſily diſperſed: In this ſtate, indeed, they ſeldom require attention; but when they become larger than uſual, an immediate application of diſcutients ſhould be adviſed. Aſtringents are to be more depended on than any other remedy, and of this claſs brandy and other ardent ſpirits are perhaps as uſeful as any.

Compreſſes, wet in a ſolution of crude ſal ammoniac in vinegar, and applied with moderate preſſure, have likewiſe proved effectual.

Inſtances, however, ſometimes happen, although not frequently, of the collection of blood being in too great quantities to admit of being all abſorbed: In ſuch caſes, as no ſuppuration can happen, from nothing but red blood being contained in the tumor, which cannot be converted into purulent matter, it ought to be immediately laid open as ſoon as there is reaſon to ſuppoſe that no farther diminution of ſize will probably occur from abſorption. This being done, and the coagulated blood evacuated, the ſore falls to be treated like any ordinary wound.

But theſe tumors are in general of little importance when compared with other accidents which ſometimes proceed from blood-letting. The firſt of theſe of which we are to treat, are wounds of arteries.

SECTION III.

Of Wounds of the Arteries.

IN all the ſmaller arteries, openings may be made with little or no riſk; but we know from experience, that wounds in the larger arteries often prove hazardous, and ſeldom heal eaſily.

When, in blood-letting, we have reaſon to ſuſpect that an artery has been wounded, by the lancet having paſſed through the vein, and that blood is diſcharging at the ſame orifice, both from the artery and vein, it becomes a matter of importance for an operator to know with preciſion whether it is ſo or not. There is only one way in which complete certainty can be obtained on this point; and it is this:

When the blood comes from the vein only, if a degree of preſſure is applied both immediately above and delow the orifice ſufficient for compreſſing the ſides of the vein, all farther evacuation of blood ſhould inſtantly ſtop, even when the preſſure is not ſo conſiderable as to affect the artery below; but if part of the blood comes from a wound in the artery, this preſſure upon the vein, inſtead of putting a ſtop to the diſcharge, will rather tend to increaſe it. When at the ſame time the blood is diſcharged *per ſaltum*, this will no doubt ſerve as a farther proof, but this teſt of itſelf, I may remark, is not ſo deciſive as is commonly imagined; for, a vein lying immediately contiguous to a large artery, receives the influence of the arterial pulſation in ſuch a degree, that any orifice made in it diſcharges blood very nearly in the ſame manner as if the artery itſelf was cut. No other proof, however, is neceſſary of the artery being wounded, than the one I have mentioned; for, if after the veins are thoroughly compreſſed, both above and below the orifice, blood ſhould ſtill flow with force, no doubt could remain of the artery being wounded. In all ſuch trials, it is ſcarcely neceſſary to obſerve, that in compreſſing the veins, care ſhould be taken not to affect the artery.

In ſuch circumſtances, it is the common practice to tie up the part with as much firmneſs as poſſible, in the firſt place with different compreſſes placed over the orifice of the vein; and leſt theſe ſhould not be ſufficient, a piece of money or other hard ſubſtance is commonly added, and the whole ſecured with a roller very tightly applied. But what are we to expect from much preſſure applied in this manner? It will not be ſaid, that it ſhould be ſo conſiderable, as to compreſs the artery itſelf; for, in that caſe, a ſtop would be put to the circulation in the whole limb: While, again, if the force is in ſuch a degree as to compreſs the ſides of the veins only, one certain effect of this muſt be, to occaſion a conſiderable reſiſtance to the flow of blood from the artery: and the blood being thus obſtructed in its natural courſe, will neceſſarily be much more readily effuſed at the opening in the artery, than if the veins had been all left free and pervious to receive and tranſmit it.

In all ſuch caſes, therefore, inſtead of applying much preſſure, ſuch means ſhould be adviſed as will with moſt certainty tend to relax the veins; and in order to command the blood, the lips of the wound ſhould be laid together, and retained by ſtraps of adheſive plaſter, without any bandage. And as there is not a more effectual method of relaxing the whole ſyſtem, and the vaſcular ſyſtem in particular, than by diſcharging large quantities of blood quickly, as ſoon as it is known that an artery is hurt, as much blood ſhould be diſcharged by the orifice newly made, as the patient can eaſily bear. In this manner, and by enjoining ſtrict attention to reſt of body, in order to prevent as much as poſſible the undue action of the arterial ſyſtem, and by keeping the body cool, with the uſe of gentle purgatives, a low diet, and farther blood-lettings when neceſſary, there may always be ſome chance of ſuch wounds in arteries being brought to heal: Whereas, when much preſſure is made upon the veins, the blood being thereby prevented from flowing through them, muſt neceſſarily be forced out at the newly formed orifice in the artery; and which muſt therefore, in the moſt certain manner, prevent it from healing: In this manner there is reaſon to think that many aneuriſmal ſwellings have been produced, which, under the mode of treatment I have adviſed, would not have taken place.

In wounds of arteries, however, it frequently happens that no treatment whatever will ſucceed; the orifice in the artery will not reunite, and blood in large quantities is effuſed into the contiguous parts. Even in this ſtate of the injury, ſtrong preſſure is often adviſed, with a view to diſſipate the tumor: But unleſs the ſwelling is ſoft, and the blood contained in it ſtill remains fluid, no preſſure whatever will diſcuſs it; for, whenever the accumulated blood has become firm, we cannot ſuppoſe that preſſure will drive it back by the paſſage from whence it came. Nor does it appear, that in ſuch circumſtances, preſſure tends to forward the abſorption of extravaſated blood. From theory alone we might be induced to draw this concluſion; and in fact I have not met with an inſtance of preſſure in ſuch caſes affording any advantage.

There is indeed a variety of aneuriſm, formed by an artery being wounded by a lancet after paſſing through a vein, in which moderate preſſure proves uſeful. When an artery wounded in this manner, lies quite contiguous to the correſponding vein, the opening between the vein and artery, in ſome inſtances, remains pervious after the external orifice in the vein is cloſed, ſo as to produce a direct communication between the one and the other; and the vein in this manner receiving the full force of the arterial pulſation, while its coats are not poſſeſſed of firmneſs ſufficient to reſiſt it, a ſwelling of the vein of neceſſity takes place. In all ſuch inſtances, we may readily ſuppoſe, that moderate preſſure will prove uſeful, by tending to ſupport the diſtended vein, and thus preventing any farther increaſe of its bulk; but in no other ſwelling ariſing from blood effuſed from an artery, can preſſure anſwer any good purpoſe; while, for the reaſons I have enumerated, there is much cauſe to ſuſpect that it has often done harm.

When we are certain that an artery has been opened, and that the tumor produced by it, ariſes from blood collected in the cellular membrane around it, if keeping the limb in an eaſy relaxed poſture, and the veins free from preſſure, together with the other means that I have pointed out, do not anſwer, no other mode of treatment will be productive of any advantage.

The tumor ſtill continuing, by the communication between it and the artery being kept up, and none of the means employed for diſperſing it, proving effectual, the diſeaſe in this ſtate is to be conſidered as an aneuriſm, a variety of tumor, of which we ſhall ſpeak more particularly in Chapter IX.

SECTION IV.

Of Wounds or Pricks in the Nerves and Tendons.

WOUNDS of arteries, as well as thoſe of tendons, ought never to happen in the hands of a good ſurgeon; for, as arteries and tendons may both be diſtinguiſhed by the finger, and their ſituation thereby aſcertained, it muſt always be the fault of the ſurgeon, if the point of his lancet is not ſo directed as to avoid them. One principal cauſe of theſe accidents in blood-letting, is, as I have endeavoured to ſhow, the ordinary practice of depreſſing the point of the lancet, after it has entered the cavity of the vein. This, however, I have ſhown to be always unneceſſary, and in many inſtances highly dangerous. But although, by proper attention to this part of the operation, we may always with certainty avoid the arteries and tendons; yet it may be ſaid, that the nerves, which are ſo ſmall as not to be previouſly diſtinguiſhed, run at all times a great riſk of being injured; and we know, that when wounded, the moſt alarming ſymptoms take place, that ever ſucceed to the operation of blood-letting.

But although the nerves cannot previouſly be diſtinguiſhed, yet, if a proper direction is given to the lancet, ſo as to prevent the point of it from paſſing through the back-part of the vein, the ſame means which tend to ſecure the arteries and tendons, will, with almoſt equal certainty, prove a ſafeguard to the nerves: For, if the operator enters his lancet, as ought always to be done, on the ſuperior part of the vein, and does not cut the vein entirely acroſs, by puſhing it through the oppoſite ſide of it, he will ſeldom or never injure the contiguous nerves: for the nerves, though they run near to the veins, yet they either lie immediately below them, or ſo far down upon their ſides as to be out of all riſk of being wounded, if the orifice is made in the upper part of the vein only. I may venture to aſſert, that the nerves are never injured by a lancet entering the anterior part of a vein: It is always on the oppoſite ſide of the vein that any miſchief of this kind is produced, when the lancet, as I have already obſerved, is puſhed entirely through; which it ought never to be, and which every ſurgeon ought to have ſteadineſs enough to prevent.

But although, with very ordinary care and attention, accidents of this kind may be guarded againſt, and although I have ſhown, that the ſurgeon is almoſt in every inſtance to blame when they take place; yet experience tends to evince, either from want of attention, or from want of ſteadineſs on the part of the operator, that however eaſily ſuch inconveniences might be avoided, yet ſtill they frequently occur. Nerves, and even tendons, are ſometimes pricked, when the dreadful train of ſymptoms which ſuch accidents uſually produce, are, of courſe, very apt to enſue.

In ſome caſes the patient complains of an exquiſite degree of pain, inſtantly on the lancet being introduced; and this we may always conſider as a certain mark of a nerve or tendon being pricked: With due care and attention, the violence of pain will often abate, and at laſt ceaſe entirely, and no danger will enſue; but in ſome inſtances the pain, inſtead of abating, gradually becomes worſe; the lips of the ſore become hard and inflamed; and in the courſe of a day or two from the operation, a thin watery ſerum begins to ooze from the orifice.

If relief is not ſoon obtained, theſe ſymptoms generally continue in nearly the ſame ſtate for ſeveral days: Thereafter the pain becomes ſtill more diſtreſsful; but inſtead of being ſharp and acute, it is now attended with the ſenſation of a burning heat. The fulneſs in the lips of the wound becomes more conſiderable, and the ſwelling in the neighbouring parts extends over the whole member, from the foot upwards over the thigh, when the operation has been done in the lower extremity; and from the elbow down the fore-arm, and upwards along the humerus over to the pectoral muſcle and other contiguous parts, when at the uſual place of blood-letting in the arm.

The parts at laſt become tenſe and hard; an eryſipelatous inflammatory colour frequently appears over the whole; the pulſe by this time is generally hard and quick; the pain is now intenſe; the patient reſtleſs; twitchings of the tendons occur; in ſome a locked jaw ſupervenes; and, all theſe ſymptoms continuing to increaſe, it moſt frequently happens, that the miſery of the unfortunate patient is only terminated by death.

Blood-letting, from being ſo frequently practiſed, may by many be conſidered as an operation neither ſo difficult to perform, nor ſo dreadful in its conſequences, as thoſe that I have enumerated; and it muſt be allowed, that they are not frequent; but they happen often enough to evince the importance of this operation.

ration. In the courſe of my experience I have known many inſtances of blood-letting ending in death, and the dreadful train of ſymptoms I have mentioned occurred in all of them.

Different opinions have prevailed reſpecting the cauſe of theſe ſymptoms: By ſome they have been imputed to wounds of the tendons; while by others the tendons are ſuppoſed to be deſtitute of ſenſibility, and that the painful ſymptoms which ſometimes ſucceed to blood-letting, proceed entirely from wounds of the nerves.

By Mr John Hunter of London, theſe ſymptoms are ſuppoſed more frequently to proceed from an inflamed ſtate of the internal ſurface of the vein, than from any other cauſe. Such a ſtate of the vein he has often traced in horſes that have died of ſuch ſymptoms from veneſection, where the internal coat of the vein was always found much inflamed, not only in the neighbourhood of the part where the orifice was made; but in ſome along the whole courſe of the vein, even to the heart itſelf. Some inſtances have alſo occurred, of the ſame appearances in the human body, where the veins after death were found highly inflamed. And on other occaſions, inflammation having in this manner been once excited, ſuppuration has at laſt enſued from it; and the matter thus produced, being in the courſe of circulation carried to the heart, Mr Hunter ſuppoſes, that in ſuch caſes death may have been induced by that cauſe alone.

There can be no reaſon to doubt the fact held forth by Mr Hunter, that in ſuch inſtances the vein in which the orifice has been made, has ſometimes after death been found inflamed: But, however ingenious his arguments may be, for concluding that this ſtate of the vein is the original cauſe of all the bad ſymptoms; and although we muſt allow, that inflammation of a vein muſt tend to aggravate all the ſymptoms previouſly induced by other cauſes, yet I think we may conclude,

clude, that it could not in any inſtance account in a ſatisfactory manner for their firſt production.

In all the inſtances of this dreadful malady which I have met with, the patient at the very inſtant of the operation, felt a ſevere degree of pain. In ſome caſes, the violence of the pain was almoſt inſupportable. Now, this we can never ſuppoſe to happen from the mere puncture of a vein; for although the coats of veins are not perhaps entirely deſtitute of feeling, yet we know that they are not endowed with much ſenſibility. This inflamed ſtate of the veins, therefore, which in ſome caſes has been obſerved after death, muſt be conſidered rather as the effect, than the cauſe, of theſe ſymptoms; and that they ſhould frequently excite inflammation in the contiguous veins, is highly probable. In the courſe of a ſhort time from the operation, when the febrile ſymptoms commence, ſuch a degree of hardneſs and inflammation is induced over all the contiguous parts, that it would be ſurpriſing indeed if the vein, which is thus perhaps ſurrounded with inflamed parts, ſhould not be inflamed likewiſe.

We may therefore conſider this inflamed ſtate of the veins as a conſequence, rather than the cauſe, of theſe ſymptoms; and of courſe we revert to the opinion of their proceeding either from the wound of a nerve or tendon.

Some have indeed attempted to ſhow, as I have already remarked, that tendons are almoſt totally deſtitute of ſenſibility; and therefore, that wounds of tendons can never account for the various ſymptoms which ſometimes enſue from blood-letting.

There is reaſon, however, to think, that, in different inſtances, the ſame train of ſymptoms have been induced by each of theſe cauſes; that in one inſtance a wounded nerve, and in others pricks of tendons, have given riſe to them. Being decidedly of this opinion myſelf, I think every perſon muſt be ſo, who has attentively conſidered the ſubject; but as the ſame method of treatment proves equally applicable, whether the diſeaſe has originated from the wound of a nerve or tendon, I do not think it neceſſary to enter upon a more minute diſcuſſion of the queſtion. Having in a former ſection ſhown how ſuch accidents may be almoſt always avoided, we ſhall now proceed to conſider the means beſt calculated for preventing the ſymptoms coming to an alarming height, when it is diſcovered that, either from inadvertence or any other cauſe, the miſchief has actually happened.

Whenever a patient, at the time of the operation, complains of an exquiſite degree of pain, we may conclude that ſome parts have been wounded which ought not to have been touched. When this unfortunately happens, if proper attention is immediately given, much may be done to obviate the acceſſion of thoſe ſymptoms which otherwiſe will undoubtedly take place.

In order to prevent as much as poſſible the acceſſion of inflammation and other ſymptoms, a large quantity of blood ſhould be immediately diſcharged at the orifice newly made; the limb, for ſeveral days, ſhould be kept in a ſtate of perfect reſt; care ſhould be taken that the muſcles of the part are preſerved in as relaxed a ſtate as poſſible; the patient ſhould be kept cool; on a low diet; and, if neceſſary, gentle laxatives ſhould be adminiſtered.

By this management alone, the fatal ſymptoms that I have enumerated, may frequently be prevented; and when they take place where theſe precautions have been omitted, we may often conclude that they proceed more from negligence in the ſubſequent treatment, than from any thing peculiarly bad in the nature of the original accident.

If, however, notwithſtanding of the means that I have adviſed, the ſymptoms continue to increaſe, if the lips of the orifice turn hard and more inflamed, if the pain becomes more conſiderable, and eſpecially if the ſwelling begins to ſpread, other remedies muſt be employed: In this ſituation, leeches applied upon the lips of the wound, frequently give relief; and when the pulſe is full and quick, it even becomes neceſſary to evacuate large quantities of blood, by opening a vein in ſome other part.

The external remedies uſually employed here, are, fomentations and warm poultices; but I have ſeldom known any advantage ariſe from them: On the idea of their being able to induce a free and kindly ſuppuration in the wound, and having reaſon to think, from their effects in ſymptoms of the ſame kind ariſing from other cauſes, that they would prove equally uſeful here, I muſt own that in various inſtances I adopted the practice in the greateſt poſſible degree. Unfortunately, however, the advantages reſulting from it never anſwered my expectation; ſo that at laſt I was induced to make trial of very different remedies.

Although, on firſt entering on the free uſe of warm emollients, I did not particularly advert to the cauſe of their failure, yet I now think that it may be eaſily explained. The parts principally concerned here being almoſt entirely membranous, and being therefore, as I have elſewhere ſhown*, incapable of yielding purulent matter, a continued courſe of warm emollients, inſtead of producing the wiſhed for effect, muſt probably render all the ſymptoms more ſevere; for when remedies of this claſs do not induce a free ſuppuration, they tend, by the heat which they convey, to act as a ſtimulus, and hence increaſe the inflammation: And in fact we find, that all theſe applications, inſtead of proving uſeful, rather do harm. The heat of the part is here one of the moſt diſtreſsful ſymptoms; ſo that inſtead of affording relief, any additional warmth rather tends to augment this very tormenting ſource of uneaſineſs. The lips of the wound, not being capable of yielding good matter, are, by the additional heat which warm poultices and fomentations convey to them, rendered ſtill more hard, ſwelled, and of courſe more painful, and the ſwelling alſo becomes more diffuſed over the reſt of the limb.

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* *Vide* Chapter I.

By Ambroſe Paré, Dionis, Heiſter, and others, inſtead of emollients, oil of turpentine, tincture of myrrh, and other heating applications, are recommended. That theſe would not prove effectual, I cannot from experience pretend to ſay; for ſuſpecting that they might prove too powerfully irritating to parts rendered already exquiſitely ſenſible by diſeaſe, I have never ventured to uſe them: But I can from repeated experience aſſert, that cooling aſtringent applications afford much more eaſe, and prove much more effectual, than warm emollients; and of this claſs, the moſt effectual I have ever employed are the ſaturnine remedies: The parts affected being alternately covered with cloths wet with a ſolution of ſaccharum ſaturni, and pledgets ſpread with Goulard's cerate, are kept more cool and eaſy than by any other remedy I have uſed.

In all ſuch caſes, therefore, as ſoon as a ſufficient number of leeches have been applied, and have diſcharged freely, the ſwelling ſhould be covered with pieces of ſoft linen wet in a ſaturnine ſolution; and theſe being kept conſtantly moiſt for the ſpace of a few hours, ſhould be ſucceeded by Goulard's cerate; and thus every part in any degree ſwelled or pained, ſhould be alternately covered with one or other of theſe applications, as long as theſe ſymptoms continue.

The febrile ſymptoms muſt at the ſame time meet with attention: The patient ſhould be kept cool, and on low diet: his ſkin ſhould be kept moiſt with Dovar's powder: gentle laxatives ſhould be given when neceſſary, and if the pulſe becomes full, hard, or quick, farther quantities of blood ſhould be taken.

In violent degrees of pain, opiates ſhould be freely given, and when twitchings of the tendons and other convulſive ſymptoms ſupervene, they become ſtill more neceſſary. In order, however, to have much influence in this ſtate of the complaint, they require to be given in full doſes; otherwiſe, inſtead of proving uſeful, they conſtantly aggravate the ſymptoms, not only by increaſing the heat and reſtleſſneſs, but by rendering the ſyſtem more irritable, and therefore more ſuſceptible than it was before of the pain ariſing from the wound: Whenever opiates, therefore, are in ſuch circumſtances employed, the doſes ought to be large.

It often happens, however, in this very alarming ſituation, either from neglect at firſt, or from an improper ſubſequent treatment with warm emollients, that opiates and the other remedies I have mentioned are afterwards uſed in vain: The fever, pain, and ſwelling of the parts, continuing, convulſive twitches of the muſcles at laſt ſupervene, all tending to indicate the moſt imminent danger. In this ſituation, if we do not immediately employ the moſt effectual remedy, the patient muſt ſoon be cut off; and the only remedy from which any real advantage can enſue, is a free and extenſive diviſion of the parts in which the orifice producing the miſchief was at firſt made. From the repeated experience of ages, we know, that much more pain and diſtreſs is excited by the partial diviſion either of a nerve or tendon, than from their being cut entirely acroſs. Now, the intention of this operation is to complete the diviſion of the nerve or tendon that have been wounded by the point of the lancet, and which I am induced in all ſuch caſes to conſider as the chief cauſe of the ſubſequent diſtreſs.

As the operation, however, is attended with much pain, and being put in practice for the removal of ſymptoms from which it is perhaps difficult to perſuade the patient that any danger is to be dreaded, all the remedies I have mentioned ſhould firſt be employed before it is propoſed: But, at the ſame time, care ſhould be taken, that the ſymptoms be not allowed to advance too far before we adviſe it; for when the patient is much weakened by the feveriſh ſymptoms having continued long violent, neither this nor any other remedy with which we are acquainted, has much influence. As ſoon, therefore, as the remedies I have adviſed have been fairly tried, and are found to be inadequate, we ſhould immediately propoſe a free diviſion of the parts chiefly affected; and the manner of doing it is this.

As all the contiguous parts are now ſuppoſed to be much ſwelled and inflamed, it is impoſſible to get clear acceſs either to the nerve or tendons, but, by means of a large and extenſive inciſion; and as this cannot be done but with the riſk of opening the contiguous arteries, the firſt ſtep to be taken, is to guard againſt this occurrence by applying a tourniquet on the upper part of the limb. This becomes neceſſary, not only for preventing the loſs of blood which would enſue from a diviſion of any of the large arteries, but for preventing that interruption which would otherwiſe happen from a conſtant diſcharge of blood from the ſmaller veſſels during the operation. The tourniquet indeed is more particularly requiſite for this purpoſe, than for any other; for although it is proper, by means of it, to guard againſt the danger of wounding any of the large arteries, yet, with proper caution, this may for the moſt part be avoided.

The tourniquet, then, being properly applied, a tranſverſe cut ſhould be made with a common ſcalpel, in the parts chiefly affected, and it ſhould run in a direction exactly acroſs the original orifice in the vein.

In no operation is it more neceſſary than in this, to act with freedom in laying the parts ſufficiently open by a free inciſion. A ſmall inciſion excites nearly the ſame pain with a larger cut; and it has this material diſadvantage, of preventing the ſurgeon from proceeding in the future ſteps of the operation with that eaſe and expedition which the nature of the caſe very commonly requires.

The ſkin and other teguments being thus freely divided, the operator muſt make one ſlight inciſion after another, taking care, if poſſible, to avoid the larger arteries and veins; and he is to go on in this way, to diſcover the wounded nerve; or if there is no poſſibility of doing ſo, he muſt ſtill continue to proceed in this gradual manner, till he has divided every part between the ſkin and perioſteum; the tendons, larger arteries, and veins excepted.

At this time the tourniquet ſhould be looſened; when in all probability the patient will expreſs much ſatisfaction at what has been done: For, if the part is thus divided which was originally pricked by the lancet, immediate relief will be obtained; while, on the contrary, if the pain remains violent, we may be thereby convinced that the miſchief lies in one or other of the tendons. An accurate examination, therefore, ſhould now be made, by clearing the parts with a ſponge; and that tendon lying moſt contiguous to the vein in which the orifice was made, will moſt probably either be found pricked, or in an evident ſtate of inflammation; but at all events, whether any ſuch appearances are diſcovered or not, there ſhould be no heſitation in dividing that tendon which lies moſt contiguous to the vein; or if two or even three tendinous extremities ſhould lie in the way, and are all therefore equally liable to ſuſpicion, they ought all to be cut acroſs: This being done, relief will for the moſt part be immediately obtained; and, at any rate, this being done, every attempt will have been made from which there could be reaſon to expect any advantage.

The parts being thus freely divided, the tourniquet ſhould now be undone, and ſuch arteries as have been wounded, ſhould be ſecured with ligatures. The parts are then to be covered with eaſy dreſſings, and afterwards treated in the ſame manner as a wound from any other cauſe.

The means of relief which I have thus adviſed, if every circumſtance be not duly weighed, may probably be conſidered as ſevere; for an inciſion in theſe parts, carried to ſuch a depth, muſt no doubt be attended with much pain, while the diviſion of one or more tendons will produce a partial lameneſs of the whole member: But if we conſider for a moment the importance of the object in view, all ſuch fears muſt immediately fall to the ground: It is not a trifling advantage we are in purſuit of, nor ſhould ſuch a painful operation be ever propoſed but in the moſt urgent circumſtances. In the preſent inſtance, however, the patient's life is obviouſly to depend on the event of this operation; ſo that the moſt timid operator, if capable of reflection, muſt admit the propriety of putting it in practice; and from the event of every caſe that has once advanced to the length for which I have adviſed this operation, it may with certainty be pronounced, that patients in ſuch circumſtances are in the utmoſt hazard; ſo that in ſuch a deſperate ſituation, no remedy that affords any tolerable chance of a recovery, however painful it may be, can with propriety be condemned.

From reaſoning alone, we might conclude, that in ſuch circumſtances no other remedy would prove ſo ſucceſsful; but when the propriety of the meaſure is enforced by the ſucceſsful iſſue of repeated trials, no argument adduced againſt it can meet with much attention. In various inſtances of leſs importance, I have known much advantage derived from this practice; and, in one inſtance, from bleeding in the median cephalic vein of the arm, the ſymptoms had got to ſuch a height, and had ſo obſtinately reſiſted every other remedy, that there was much cauſe to dread that death muſt have enſued, had it not been for the effects of a free and very deep diviſion of the pained parts. The patient, from being in exquiſite pain, and in imminent danger, experienced almoſt inſtantaneous relief; and the ſwelling, which had previouſly continued obſtinate, began ſoon to abate, and a perfect recovery was obtained in much leſs time than could have been looked for.

There is not, therefore, a point in ſurgery, of which I am more convinced, than of the propriety of this operation in all ſuch deſperate caſes as the one of which we have been treating; but to ſuch as have not met with occurrences of this kind, the remedy propoſed will not only appear to be too violent for the diſeaſe, but they will alſo be induced to conſider the length of diſcuſſion, I have gone into as more prolix than neceſſary: A ſingle inſtance, however, of the dreadful ſymptoms induced by this kind of accident, will be ſufficient to convince any one, of the ſubject we have thus been conſidering, being perhaps one of the moſt important in the department of ſurgery.

All that I have hitherto ſaid on blood-letting, relates to the operation in general: I ſhall now proceed to conſider the operation as it is done in particular parts; and firſt of blood-letting in the arm.

SECTION V.

Of Blood-letting in the Arm.

BLOOD-LETTING is more frequently practiſed on the fore-part of the arm at the joint of the elbow, than in any other part. The veins are in general more conſpicuous in this place; but no other reaſon can be aſſigned for it. On the contrary, the near contiguity of nerves, tendons, and large arteries to theſe veins, makes it more hazardous here than in other parts. From this, I have often been induced to conſider our fixing on this part for the ordinary operation of blood-letting as a very important error; eſpecially as blood may be drawn from veins in other parts, with the ſame eaſe as from thoſe of the arm, and with leſs danger; particularly from the veins of the neck, hands, ankles, and feet.

Blood-letting in the lower extremities has chiefly been confined indeed to a particular ſet of diſeaſes, eſpecially to thoſe of females: But no good reaſon can be aſſigned for this; for it is now known, that, in general blood-letting, the place from whence the blood is drawn, is of little importance, and that the effects of the operation depend almoſt entirely on the quantity diſcharged in a longer or ſhorter time.

Blood-letting at the arm may be ſafely performed by ſurgeons of ſteadineſs and attention, as in the hands of ſuch men there is little or no riſk of the lancet going deeper than the vein, and in this caſe nothing bad can enſue: But in common practice, it would be better to fix upon ſome other part. It may almoſt always be done with eaſe in the hands, feet, and ankles; and if the operation is properly performed, the ſame quantity of blood may be drawn from the veins of theſe parts, as from thoſe of an equal ſize in any other part of the body.

But whether this idea ſhould ever be generally adopted or not, it is at leaſt certain, if the cautions I have pointed out are proper in other parts, they are much more ſo in the arm, where the veins lie ſo very contiguous to parts which cannot be wounded, but with the riſk of producing ſymptoms of the moſt alarming tendency.

Having already conſidered the various ſteps of the operation of blood-letting, ſo far as they relate to it in a general view, in order to avoid repetitions, nothing will be mentioned now but what is particularly required in taking blood from the arm.

In applying the ligature for compreſſing the veins, it ſhould be placed an inch or an inch and half above the joint of the elbow; and, in order to prevent the ends of it from coming in the way of the lancet, the knot ſhould be made on the outſide of the arm. In general, one knot might anſwer; but a ſlip-knot being made above the firſt, renders it more ſecure, and it is very eaſily done.

In making choice of a vein from whence blood is to be taken, the general rules we have laid down upon this point, in the firſt ſection of this chapter, muſt be kept in view. That vein which appears moſt conſpicuous, at the ſame time that it rolls leaſt under the ſkin, ſhould in general be made choice of; but when an artery is found to lie immediately below, and quite contiguous to the vein, the operator, if not perfectly ſatisfied with his own ſteadineſs, ought rather to prefer another. For the moſt part, however, the artery lies ſo low in this place, that the median baſilic vein, under which it commonly runs, may be opened with ſafety; and as this vein is uſually more conſpicuous than the others, it is for this reaſon in general to be conſidered as the beſt. Beſides, we prefer the median baſilic, from its being leſs deeply covered with cellular ſubſtance than the cephalic or median cephalic; and by lying towards the inner part of the arm, it is more thinly covered with the tendinous expanſion of the biceps muſcle, than either of the others.

thers. From theſe circumſtances, the operation is alſo attended with leſs pain in this than in the other veins; a conſideration which in every operation merits our regard.

In blood-letting at this part of the arm, although it may be done with the right hand, either upon the right or left arm of the patient; yet we do it more neatly with the right hand upon the right arm, and with the left hand on the left arm of the patient; and whoever attempts the contrary, muſt find that it cannot be done but in an awkward manner, as the operator cannot in any other way apply his hand properly to that part of the arm on which it ought to reſt.

In corpulent people, the veins ſometimes lie ſo deep as not to be diſcovered by the eye; but when they are ſenſibly felt by the fingers, even although they cannot be ſeen, they may be opened with freedom. In a few inſtances, however, they can neither be diſtinguiſhed by the eye, nor with the finger: In this caſe, the ligature ſhould be removed from the upper part of the arm, and applied about half-way between the elbow and wriſt, by which the veins below will be brought into view; and wherever a vein can be evidently obſerved, there can be no danger in performing the operation. This I have often found neceſſary, nor has any inconvenience ever enſued from it.

SECTION VI.

Of Blood-letting in the Jugular Vein.

INFLAMMATION of the throat and of the eyes, as well as other affections of the head, frequently require blood to be taken from the contiguous parts; particularly from the external jugular veins: The manner of opening theſe veins is this:

There is only one ramification of the jugular vein, namely, the principal poſterior branch, that can eaſily be brought ſo much into view, as to be with propriety opened; and even this lies deeply covered, not only with the ſkin and cellular ſubſtance, but with the platiſma myodes muſcle, ſo that a good deal of preſſure is required to raiſe it. With a view to produce this, the thumb of the operator is commonly placed upon the vein, ſo as to compreſs it about an inch or inch and half below where the opening is to be made. This, however, is ſeldom ſufficient, as the blood, on being ſtopped in its progreſs through this branch, finds an eaſy paſſage to the other veins; ſo that unleſs the principal vein on the other ſide of the neck is alſo compreſſed, the vein to be opened can never be fully diſtended. In order to diſtend it ſufficiently, a firm compreſs of linen ſhould be applied on the largeſt vein on the oppoſite ſide of the neck; and a garter, or any other ligature, being laid over it, a firm knot ſhould be tied below the oppoſite arm-pit; taking care to make ſuch a degree of preſſure, as may put an entire ſtop to the circulation in the vein, which in this way is eaſily done, without obſtructing reſpiration.

This being done, and the patient's head properly ſupported, the operator, with the thumb of his left hand, muſt make ſufficient preſſure upon the vein to be opened, while, with the lancet in his right-hand, he ſhould penetrate at once into the vein; and, before withdrawing the inſtrument, the orifice ſhould be made ſufficiently large for the intended evacuation. It may be proper to obſerve, that a larger opening is neceſſary in the neck than in the arm, otherwiſe the quantity of blood is procured with difficulty: And, beſides, there is not here the ſame neceſſity for caution on this point that there is in the arm: for in the neck, we meet with no difficulty in putting a ſtop to the blood: after removing the ligature, all that is commonly neceſſary, even when the orifice is large, is to cloſe it with a ſlip of adheſive plaſter.

In order to bring the vein more clearly into view, ſo as afterwards to be able to open it with more accuracy, ſome have directed, that the ſkin, cellular ſubſtance, and muſcular fibres covering the vein, ſhould be previouſly divided with a ſcalpel. This, however, is unneceſſary; and it renders the operation both more painful and more tedious than when done with the lancet at once.

SECTION VII.

Of Blood-letting in the Ankles and Feet.

WHAT has already been ſaid on the operation of blood-letting, renders it unneceſſary in this place to be minute. When blood is to be taken from the veins of theſe parts, it will be readily underſtood, that our firſt object ſhould be to compreſs the veins, ſo as to produce an accumulation of their contents. The ligature being applied ſufficiently tight a little above the ankle-joint, all the branches of the vena ſaphæna, both in the inſide and outſide of the foot, come at once into view; and as this vein is every where ſuperficial, being in general covered with ſkin only, wherever it appears conſpicuouſly, it may with ſafety be opened.

With a view to encourage the diſcharge of blood, it has been a conſtant practice in opening theſe veins, to immerſe the feet in warm water immediately on the orifice being made. But this is a very inaccurate method, as the quantity of blood taken in this manner can never be aſcertained, from being all mixed with the water: Neither is the aſſiſtance of warm water neceſſary; for when all the veins are ſufficiently compreſſed, and the orifice of a proper ſize, I never find more difficulty in obtaining a full diſcharge of blood from theſe veins, than from thoſe in other parts of the body.

On removing the ligature, however, the blood ſtops eaſily; ſo that a piece of adheſive plaſter applied over the orifice, anſwers all the purpoſes of a bandage.

Theſe are the ſeveral parts from whence blood is uſually taken by veneſection; but in ſome inſtances, where the contiguous parts have been particularly affected, it has been judged adviſable to open the veins of other parts, as thoſe of the tongue, of the penis, the eye, and the external hemorrhoidal veins. When blood is to be diſcharged in this manner from the penis, the veins can be eaſily brought into view by preſſure with a ligature; but, in the tongue, in the hemorrhoidal veins about the anus, and other parts where compreſſion cannot be applied, all that can be done, is, to make an orifice of a proper ſize in the moſt conſpicuous part of the vein; and if a ſufficient diſcharge cannot in this manner be obtained, it may be neceſſary in ſuch circumſtances to put the parts in warm water; and, for ſome time, to keep them immerſed in it.

Having thus conſidered the various modes of diſcharging blood by veneſection, we now proceed to arteriotomy.

SECTION VIII.

Of Arteriotomy.

WHATEVER advantages may in theory have been expected from Arteriotomy, and however keenly ſome may in their cloſets have given it their ſupport, not only as being in many inſtances preferable to veneſection, but as an operation perfectly ſafe; yet the moſt ſtrenuous friends to the practice have ſhrunk from attempting it on large arteries. Inſtances, indeed, have occurred of large arteries being opened, and no dangerous conſequences taking place; but they are ſo exceedingly rare, that no practitioner of experience will be induced by them, deliberately, or from choice, to adopt the practice. The ſmaller branches of arteries may indeed be opened with ſafety when not deeply covered, and eſpecially when they lie contiguous to bones; for in theſe ſituations, as ſoon as the quantity intended to be taken is diſcharged, all farther loſs of blood may be prevented by compreſſion; but the opening of any of the larger arteries muſt be always attended with ſo much hazard, and the advantages to be expected from it in preference to veneſection are apparently ſo trifling, as muſt probably prevent it from ever becoming general.

We know of few arteries, therefore, which with propriety can be opened; the different branches of the temporal are thoſe indeed from whence blood in ordinary practice is ever taken: but, if a fanciful practitioner ſhould at any time incline to take blood in this manner from a different part, it may be done with ſafety from one of the arteries running on each ſide of the fingers. About the middle of the laſt phalanx, this artery is ſufficiently large for diſcharging a conſiderable quantity of blood; in moſt caſes it lies ſuperficial, and in this ſituation there can ſeldom be much difficulty in putting a ſtop to the diſcharge: In performing this operation on any of the temporal branches, if the artery is ſuperficial, it may be done with one puſh of the lancet, in the ſame manner as in veneſection; but, when the artery is deeply covered, it ſhould be previouſly brought into view, by cutting the ſkin before making the orifice with the lancet: For when the ſmaller arteries are cut entirely acroſs, they never bleed freely, from their being apt to retract more or leſs within the ſurrounding parts.

Some nicety is therefore neceſſary in making the opening into the artery: It ſhould neither be quite acroſs, nor directly longitudinal; for it never bleeds ſo freely, either in an artery or vein, when quite longitudinal, as when ſomewhat oblique.

When the opening is properly made, and the artery of a moderate ſize, it will at once diſcharge freely, without being compreſſed; but the diſcharge may be increaſed at pleaſure, by compreſſing the artery immediately above the orifice, between it and the correſponding veins. The quantity of blood being thus diſcharged, a very ſlight compreſſion on theſe ſmaller arteries will ſuffice for putting a ſtop to the evacuation: For the moſt part, any preſſure that is neceſſary may be applied here as in veneſection, by means of a linen compreſs and roller: the orifice being firſt entirely cleared of blood, and properly covered with adheſive plaſter. If this ſhould not prove ſufficient, a compreſs of linen ſhould be applied over it, and the whole ſecured with a roller.

In ſome inſtances even this does not ſucceed, and the orifice continues to burſt out from time to time, ſo as to produce much inconvenience and diſtreſs.

In this ſituation we have different methods of putting a ſtop to the diſcharge. 1*ſt*, If the artery is ſmall, as all the branches of the temporal arteries commonly are, cutting it entirely acroſs, exactly at the orifice made with the lancet, by allowing it to retract within the ſurrounding parts, for the moſt part proves ſufficient. 2*d*, When the patient does not conſent to this, we have it always in our power to ſecure the bleeding veſſel with a ligature, as would be done with an artery accidentally divided in any part of the body. And, laſtly, when the patient will not conſent to either of theſe, we may, by regular continued preſſure, obliterate the cavity of the artery at the point where the opening was made, and thus produce an accretion of its ſides. Different bandages have been contrived for compreſſing the temporal artery; but none of them anſwer the purpoſe ſo well as the one repreſented in Plate V. fig. 2.

As ſome time, however, is required to obliterate the cavity of an artery, this method is accordingly more tedious: but with timid patients it proves more acceptable than either of the other two.

Having thus conſidered the various means employed for evacuating blood from the larger arteries and veins, we now proceed to the conſideration of topical blood-letting.

SECTION IX.

Of Topical Blood-letting.

WHEN, either from the ſeverity of local inflammation, or from any other cauſe, we wiſh to take blood directly from the veſſels of the part affected, the following are the different methods we employ for it. The application of leeches; ſcarifications with a lancet, or ſome other ſharp inſtrument; and, laſtly, by means of an inſtrument termed a Scarificator, containing from one to twenty lancets, or more: In this inſtrument, Plate VII. fig. 1. the lancets are fixed in ſuch a manner, that when applied to the part from whence we wiſh to take blood, the whole number are driven ſuddenly into it, by means of a ſpring, and to a greater or leſſer depth, at pleaſure. This being done, as it is the ſmaller blood-veſſels only that by this operation are ever meant to be cut, and as theſe ſeldom bleed

freely, different means are employed fc
promoting the diſcharge.

Various methods have been propoſe
for this. Glaſſes fitted to the form of th
parts, with a ſmall hole in the bottom c
each, were long ago contrived; and the
being placed upon the ſcarified parts,
degree of ſuction was produced by a pei
ſon's mouth, ſufficient for nearly exhauſt
ing the air contained in them*. This ac
cordingly was a very certain method c
increaſing the evacuation of blood, but a
it was attended with a good deal of trou
ble, while it did not always prove ſuffi
ciently powerful, an exhauſting ſyring
was at laſt adapted to the glaſs, whicl
ſerved indeed to extract the air containe
in it, but being troubleſome in the ap
plication, and practitioners finding it dif
ficult to preſerve the ſyringe always air
tight, this part of the operation has fo
a conſiderable time been chiefly done b
applying heat in ſuch a manner to th
glaſſes, as to rarify the air which the
contai

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* Celſus, lib. 2. cap. 11.

contain in a degree ſufficient for producing a conſiderable ſuction. And as the inſtrument in this ſimple form anſwers the purpoſe in view, the uſe of the ſyringe will probably be laid altogether aſide. The glaſſes for this purpoſe, it is evident, muſt be entire; for if the leaſt communication is allowed between their cavities and the ſurrounding atmoſphere, no effect will reſult from them.

Different methods are employed for thus applying heat to the cavity of the glaſs. By ſupporting the mouth of it for a few ſeconds above the flame of a taper, the air may be ſufficiently rarified; but if the flame is not kept exactly in the middle, and is allowed to touch either the ſides or bottom of the glaſs, it is apt to crack and fly in pieces. A more certain, as well as an eaſier method of applying the heat, is to dip a piece of ſoft bibulous paper in ſpirit of wine, and having ſet it on fire, to place it in the bottom of the glaſs, and, on the flame being nearly extinguiſhed, inſtantly to apply the mouth of the inſtrument upon the ſcarified part. This degree of heat, which may be regulated by the ſize of the paper, and which ought to be always in proportion to that of the glaſs, if long enough applied, proves ſufficient for rarifying the air, and at the ſame time, if done with caution, never injures either the glaſs or the patient.

If the ſcarifications have been properly made, they inſtantly begin to diſcharge freely on the glaſs being applied: On being nearly full of blood, it ſhould be taken away, by raiſing one ſide of it, or by undoing a ſcrew fitted to a ſmall opening in the bottom, ſo as to give acceſs to the external air. When more blood is to be taken, the parts ſhould be bathed with warm water; and, being made perfectly dry, another glaſs exactly of the ſize of the firſt, ſhould be inſtantly applied in the ſame manner; and thus, if the ſcarificator has been made to penetrate to a ſufficient depth, ſo as to have cut all the cutaneous veſſels of the part, almoſt any neceſſary quantity of blood may be obtained. It ſometimes happens, however, that a ſufficient quantity cannot be got at one place: In this caſe, we apply the ſcarificator as near as poſſible to the parts affected; and this being done, the application of the glaſſes muſt alſo be renewed, as before.

When we wiſh to diſcharge the quantity of blood quickly, two or more glaſſes may be applied at once on contiguous parts previouſly ſcarified; and the quantity of blood is more quickly obtained when the cupping-glaſſes are firſt applied for a few ſeconds upon the parts to be afterwards ſcarified. The ſuction thus produced by the glaſſes, ſeems to have ſome influence in bringing the more deep-ſeated veſſels into nearer contact with the ſkin, ſo that more of them are cut by the ſcarificator.

A ſufficient quantity of blood being procured, the wounds made by the lancets ſhould be all cleared of blood: and a bit of ſoft lint dipped in a little milk or cream, or ſpread with wax-ointment, applied over the whole, is the only dreſſing which they require: Dry lint is ſometimes applied, but it not only creates more uneaſineſs, but renders the wounds more apt to feſter than when previouſly covered with an emollient.

Although this operation is not difficult, yet a good deal of practice is neceſſary to perform it in a neat and ſucceſsful manner; but with proper attention, any operator may ſoon do it ſo expertly as to be able in this way to diſcharge any neceſſary quantity of blood.

In ſome caſes of local pains, and in others with a view to promote ſuppuration, an operation, termed dry-cupping, has been propoſed, and in ſome inſtances practiſed with advantage: It conſiſts in the application of the cupping-glaſſes without the uſe of the ſcarificator. In this manner, a tumor is produced upon the part; and, where any advantage is to be obtained from a determination of blood to a particular ſpot, it will not fail to anſwer.

In Plate VII. is repreſented a ſcarificator, together with different ſizes and figures of cupping-glaſſes, with which every operator ſhould be amply ſupplied, ſo as to be able to adapt a glaſs to every part from whence it may be proper to diſcharge blood.

When the part from which blood is to be diſcharged is ſo ſituated that a ſcarificator and cupping-glaſſes can be applied, this method of taking it is preferable to every other; but it ſometimes happens, that parts are ſo ſituated as not to admit of their application: Thus, in an inflamed ſtate of the eye, of the noſe, and other parts of the face, the ſcarificator cannot be applied directly to any of theſe parts. In ſuch inſtances, leeches are commonly employed; as they may with ſafety be placed upon any ſpot from which blood can be taken.

In the application of leeches, the moſt effectual method of making them fix upon a particular ſpot, is to confine them with a ſmall wine-glaſs. Allowing them to creep upon a dry cloth, or on a dry board, for a few minutes before being applied, makes them fix more readily; and moiſtening the parts on which we wiſh them to fix, either with milk, cream, or blood, tends alſo to cauſe them adhere more ſpeedily than they otherwiſe would do. As ſoon as the leeches have come away, the ordinary method of promoting the diſcharge of blood, is to cover the parts with linen cloths wet with warm water, or even with dry warm cloths: In ſome ſituations, this is perhaps the beſt method we can employ; but wherever the cupping-glaſſes can be applied over the wounds, they anſwer the purpoſe more effectually. When the ſituation and figure of the part will therefore admit of their application, they ought always to be employed.

Among other methods of performing local blood-letting, I mentioned ſcarifications made with a lancet, or ſome other ſharp inſtrument: This proves particularly uſeful in ophthalmia, and often gives immediate relief where general bloodletting has previouſly been tried in vain. By ſcarifying the turgid veſſels of the eye, ſo as to diſcharge perhaps only a few drops of blood, more advantage is often obtained than from the diſcharge of a great quantity either from the jugular veins or temporal arteries: The mere diviſion of the veſſels has in ſuch caſes indeed been ſuppoſed to prove uſeful; but I have conſtantly obſerved, that the advantage derived from this operation, has been nearly in proportion to the quantity of blood that has been taken.

Different methods have been propoſed for performing it. It may be done with the ſhoulder of a common lancet, but more neatly and more eaſily by inſtruments that I ſhall hereafter point out in Chapter XI. when ſpeaking more particularly of diſeaſes of the eye.

Among other methods that have been propoſed for ſcarifying the bloodveſſels of the eye, doing it with the beards of rough barley was at one period much extolled, and by ſome the practice is ſtill continued. By drawing the beards over the ſurface of the eye, in a direction contrary to the ſharp ſpiculæ with which they are furniſhed, a conſiderable diſcharge of blood may be produced. But the pain attending it is exquiſite; and as it does not poſſeſs any ſuperior advantage over the method of dividing the bloodveſſels with a lancet, it is now deſervedly falling into diſuſe.

I have thus finiſhed the conſideration of the various means employed in ſurgery for diſcharging blood from the ſyſtem; and as the diſeaſe termed Aneuriſm, is moſt frequently the effect of an unguarded manner of performing one of the operations that I have juſt been deſcribing, the farther conſideration of the ſubject cannot, perhaps, be any where more properly introduced than in this place, where one of the principal cauſes by which it is produced has been ſo lately treated of.

CHAPTER IX.

OF ANEURISMS.

SECTION I.

General Remarks on Aneuriſms.

BY the term Aneuriſm, was originally meant, a tumor formed by the dilatation of an artery; but modern practitioners make the term apply not only to tumors formed in this manner, but to ſuch as proceed from blood effuſed from arteries into the contiguous parts; a circumſtance which may take place either from the puncture or rupture of an artery.

A tumor, produced by the dilatation of the coats of an artery, is denominated a True Aneuriſm; and we term it a Falſe Aneuriſm, where, by the puncture or rupture of an artery, blood is effuſed into the ſurrounding parts.

As the introduction of new appellations frequently leads to confuſion, neceſſity alone can juſtify the attempt in the preſent work, therefore it will ſeldom be done; but as the treatment of Aneuriſm may be rendered more clear and diſtinct, by a change of terms applied to the different varieties of the diſeaſe, it would be culpable in an author not to propoſe it.

Where aneuriſm is produced by the dilatation of an artery, as the tumor is circumſcribed, and contained within coats peculiar to itſelf, it may with propriety be termed an Encyſted Aneuriſm; while the other, ariſing from blood ſpreading among the neighbouring parts, may with equal propriety be termed the Diffuſed Aneuriſm.

As theſe two varieties of Aneuriſm are, in many circumſtances, different from each other, it will be proper to conſider them ſeparately.

In the true or encyſted aneuriſm, the tumor, when firſt obſerved, is commonly ſmall and circumſcribed; the ſkin retains its natural appearance; when preſſed with the fingers, a pulſation correſponding with that of the artery below is diſtinguiſhed; and by compreſſion, the contents of the ſwelling, while they are yet ſoft and fluctuating, may be eaſily made to diſappear.

When means properly calculated for the removal of the diſeaſe, are not ſoon put in practice, the ſwelling begins to increaſe, it becomes more prominent, and proceeds in a gradual manner to acquire a larger ſize. The ſkin and teguments, for a conſiderable time, retain their natural appearance; the patient does not complain of pain; the tumor continues of an equal ſoftneſs; and its contents are ſtill compreſſible, yielding conſiderably, and in ſome inſtances diſappearing entirely, on the application of preſſure. At laſt, however, when it becomes large, the ſkin loſes its ordinary colour, becomes pale, and, in the more advanced ſtages of the diſeaſe, even œdematous: The pulſation ſtill continues; but the tumor, although ſoft in ſome parts, yet in others is firm, and cannot be made to yield much to preſſure, part of the contained blood having in this ſtage of the diſeaſe become hard by coagulation.

The ſwelling continuing to increaſe, at laſt becomes painful; the ſkin turns livid, apparently verging to a ſtate of mortification; an oozing of bloody ſerum iſſues from the teguments; and if gangrene does not take place, the ſkin cracks in different parts; and now the force of the artery not meeting with much reſiſtance, if the veſſel is large, a period is ſoon put to the patient's exiſtence, by the blood burſting out with ſuch violence as to produce almoſt inſtantaneous death; at leaſt in the larger arteries of the trunk of the body, this is the ordinary event of aneuriſms. In the extremities, however, the arteries are not ſo large as by their rupture to be capable of producing effects ſo immediately fatal; and beſides, we can here, by means of the tourniquet, effectually guard againſt this ſudden termination of the diſeaſe.

In aneuriſms of the larger arteries, the effects produced upon the neighbouring parts, by the conſtant pulſation and gradual augmentation of the tumor, are often ſurpriſing. The ſofter parts we might, *à priori*, expect to yield to a great extent; but the hardeſt parts of the body, probably from their not being capable of yielding, evidently ſuffer more from the effects of this kind of preſſure, than either membranes, muſcles, or ligaments. Even the bones frequently undergo a great degree of derangement by the pulſation and diſtenſion of contiguous aneuriſms: Sometimes

times they are ſeparated entirely from each other at the different joints: In ſome inſtances they are elevated out of their natural ſituations; and not unfrequently we find them entirely diſſolved.

Theſe effects of aneuriſm, however, are not common in any of the extremities: It is the ſtrong pulſation of the aorta only, or of ſome of the larger arteries at no great diſtance from the heart, that can ever produce ſuch important conſequences. Sometimes, however, ſimilar effects of an aneuriſm have been obſerved in the thigh, and upper part of the arm; even the bones of theſe parts have been deſtroyed by aneuriſms of the neighbouring arteries.

Theſe in general are the appearances and termination of the encyſted aneuriſm, to which, however, one exception occurs in a variety of the diſeaſe, to be hereafter deſcribed.

Various cauſes may tend to produce encyſted aneuriſms. 1. From daily obſervation we know, that partial debility frequently occurs in different parts of the ſyſtem: Thus, there is nothing more frequent than œdematous ſwellings of the extremities, even in conſtitutions otherwiſe healthy; and theſe ſwellings we juſtly ſuppoſe moſt frequently to depend on local weakneſs of the parts in which they occur. Now, why may not debility of a ſimilar kind fall upon part of the arterial ſyſtem? and, if this ſhould happen, it is eaſy to ſee how in almoſt every inſtance it muſt terminate in aneuriſm: For the force of the heart continuing the ſame, if any particular part of an artery has loſt its tone, as it is thereby rendered unable to reſiſt the pulſations of the heart, dilatation of its coats, muſt at theſe weakened parts neceſſarily enſue; and as ſoon as a morbid enlargement of the cavity of an artery is thus commenced, as its power of reſiſtance will be proportionally leſs, while the *vis à tergo* continues the ſame, the farther increaſe of the ſwelling is a conſequence that of courſe muſt take

This may be conſidered as the moſt frequent cauſe of aneuriſm not depending upon external violence. Aneuriſms of the aorta, ſeem in almoſt every inſtance to ariſe from this cauſe; as well as all others that do not obviouſly proceed from external injuries.

2. The external coats of an artery being deſtroyed by a wound, a partial weakneſs of the part will thus be produced; and this muſt render it liable to be acted upon by the heart and other parts of the arterial ſyſtem, in the ſame manner as if previouſly debilitated by diſeaſe.

In dilatations of an artery produced by this cauſe, the progreſs of the tumor is ſuch as I have deſcribed: The blood, from being ſtill confined within the coats of the artery, continues to form a circumſcribed tumor. At firſt the ſwelling diſappears upon preſſure; but on advancing farther, part of its contents become ſo firm by coagulation, as to render it impoſſible by compreſſion to diſperſe it. This variety of aneuriſm may ſometimes ariſe from other cauſes, but we meet with it moſt frequently from blood-letting in the arm; by the lancet, after paſſing through the vein, going ſo deep as to divide the external coats of the artery without penetrating its cavity.

3. This variety of aneuriſm has alſo been produced by the matter of ſores and abſceſſes proving ſo corroſive as to deſtroy the external coverings of the contiguous arteries: When this takes place, the ſame train of ſymptoms muſt occur, as if the outer coats of the artery had been deſtroyed by a ſharp inſtrument.

4. The bones, muſcles, and ligaments, give all ſome degree of ſupport to the arteries which they ſurround; ſo that the deſtruction of any of theſe parts muſt evidently tend to the production of aneuriſm: Indeed, the firmneſs and ſtability of parts naturally connected together, depends ſo much upon a ſound ſtate of the whole, that any one of them becoming weak and diſeaſed, generally terminates in a diſeaſed ſtate of the others. In the thigh of a patient,

tient, where part of the muſcles and other ſoft parts were deſtroyed by an extenſive mortification, different aneuriſmal ſwellings occurred in the courſe of the femoral artery which had thus loſt part of its ſupport; and no other cauſe appeared to be concerned in their production.

5. I have already remarked, that in blood-letting at the uſual place in the arm, arteries are ſometimes wounded, by the lancet paſſing through the vein into the artery below; and when the artery lies in direct contact with the vein, the blood diſcharged from the orifice in the artery, paſſing directly into the vein, ſerves to keep up a communication between them.

A communication being in this manner produced between the artery and vein, and the coats of the vein not being able to reſiſt the impulſe of the artery, a preternatural dilatation of the vein muſt neceſſarily enſue: A tumor is accordingly ſoon produced, which at firſt is ſmall and circumſcribed, but at laſt it gradually extends both above and below the orifice; not only along the courſe of the vein originally wounded, but in ſome inſtances over all the contiguous veins.

This variety of the diſeaſe was firſt accurately deſcribed by our celebrated countryman Dr William Hunter; and may with great propriety be termed the Varicoſe Aneuriſm. Since that period it has been frequently obſerved by others; ſo that its nature is now very generally underſtood.

Although the coats of the artery are here completely divided, yet, as the blood is contained within the cavity of the veins, this ſpecies of the diſeaſe is obviouſly a variety of the encyſted aneuriſm; and as the method of cure coincides, in ſome circumſtances, with that of other encyſted aneuriſms, the further conſideration of the ſubject could not any where be more properly introduced.

In the Varicoſe Aneuriſm, the ſwelling is confined entirely to the veins. Soon after the injury is committed, the vein communicating immediately with the artery begins to ſwell: In a gradual manner,

ner, the tumor becomes more remarkable, and the anaſtomoſing branches of the contiguous veins alſo become enlarged. This ſwelling of the veins may, by preſſure, be made to diſappear, the blood contained in them being in part puſhed forward in its courſe towards the heart, while part of it is ſometimes forced into the artery itſelf; and, when the tumor is large, the blood, when thus forced out of it, is heard to make a ſingular hiſſing kind of noiſe. This may be always conſidered as a very characteriſtic ſymptom of the diſeaſe; but as it is not met with in every caſe of varicoſe aneuriſm, it becomes neceſſary to point out ſuch circumſtances as more certainly ſerve as means of diſtinction.

In the varicoſe aneuriſm there is a tremulous kind of motion diſcovered in the dilated vein, attended with a particular kind of noiſe, as if air was paſſing into it through a ſmall aperture.

If a ligature is applied upon the under part of the limb, immediately below the ſwelling, and tied ſo tight, as even to ſtop the pulſe in the under part of the limb, the ſwelling in the veins, on being removed by preſſure, returns inſtantaneouſly on this being taken off, and does not appear to be affected by the ligature below; which it undoubtedly would be, were it not for this direct communication between the trunk of the artery and correſponding vein.

If the ſwelling is removed, by preſſing the blood forward to the heart, and a ſlight preſſure is made with the point of the finger on the orifice in the artery, the veins remain perfectly flaccid; nor does any ſwelling take place, till the preſſure is removed from the orifice, when it inſtantly becomes equally large as it was before; and this even happens, although the preſſure on the artery is not ſo firm as to ſtop the circulation in the under part of the limb.

In like manner, if the trunk of the artery is compreſſed above the orifice, ſo as to ſtop the circulation entirely, that tremulous motion and hiſſing noiſe in the tumor ceaſes inſtantly; and, if the veins are now emptied by preſſure, they will certainly remain flaccid till the compreſſion upon the artery is removed. In ſome inſtances too, if two ligatures be applied, one an inch or two above, and the other as much below the ſwelling, and are made ſo tight, as to ſtop entirely the circulation of the blood in the tumor lying between them; if the ſwelling is now compreſſed, all the blood contained in it is made to paſs into the opening in the artery, from whence, however, it inſtantly returns again, on the preſſure being removed. This does not indeed always happen; but its not doing ſo, is no proof of the varicoſe aneuriſm not actually exiſting; for if all or ſeveral of the other leading circumſtances of the diſeaſe which I have enumerated, ever take place, the nature of the tumor is thereby rendered evident.

In addition to other characteriſtic ſymptoms of the varicoſe aneuriſm, I may remark, that when the tumor has been of ſuch duration as to excite much dilatation of the veins, the trunk of the artery above the orifice generally becomes preternaturally large, while the branches below become proportionally ſmall; and of conſequence, the pulſe in the under part of the limb is always more feeble than in the ſound limb of the oppoſite ſide.

Having thus enumerated the ordinary appearances of all the varieties of encyſted aneuriſm, together with the various cauſes by which they are produced, I ſhall now proceed to deſcribe the ſymptoms and cauſes of the diffuſed aneuriſm, and ſhall conclude with conſidering the method of cure.

The Diffuſed, or what is commonly termed the Falſe Aneuriſm, conſiſts in a wound or rupture of an artery, producing, by the blood thrown out from it, a diffuſed ſwelling in the contiguous parts.

Some of the largeſt internal arteries are occaſionally ruptured by ſevere bodily exertion; particularly thoſe of the lungs. This probably happens from the arteries in this organ being ſurrounded with ſoft contiguous parts, which do not afford them much ſupport; for in the external parts of the body, where the arteries are more firmly ſupported, accidents of this kind are ſeldom met with. But it is chiefly in that variety of aneuriſm, produced by wounds of the more ſuperficial arteries, that ſurgery ever affords relief.

Among other conſequences of blood-letting in the veins of the arm, I had occaſion to mention wounds in the contiguous artery as one: In a few inſtances, by the treatment which I then pointed out, the bad effects which otherwiſe would reſult from it, do not take place by the wound in the artery being ſpeedily cured. This happy termination, however, of theſe injuries, is ſo rare, that it can never with certainty be looked for.

When the puncture of an artery does not heal ſpeedily, it will neceſſarily terminate in an aneuriſmal tumor; and the following is the uſual progreſs which it makes.

A ſmall tumor, about the ſize of a horſe bean, generally riſes juſt at the orifice in the artery, ſoon after the diſcharge of blood has been ſtopt by compreſſion: The tumor is at firſt ſoft, and has a ſtrong pulſation. It yields to preſſure, but never in ſuch a degree as that of an encyſted aneuriſm: For, if it be not in the more advanced ſtages of the latter, the blood remains fluid, and can be eaſily preſſed from one part of the cyſt to another; whereas, in the diffuſed aneuriſm, the blood forming the tumor is at once extravaſated; it ſoon coagulates, and thereafter becomes firm.

In this ſtate of aneuriſm, if the ſwelling is not improperly treated by the application of preſſure, it generally remains nearly of the ſame ſize for ſeveral weeks: It then begins gradually to increaſe; and if ſeated at the uſual place of blood-letting in the arm, it now proceeds farther up than the orifice, and extends rather more inwardly than towards the outer part of the arm, probably from the expanſion of the biceps muſcle not being in this place ſo firm and compact as in the external and under part of the arm. This enlargement of the tumor proceeds, too, more quickly in ſome than in others, and in ſome the ſwelling is much more diffuſed and extended than in others.

Both theſe circumſtances depend probably upon the ſame cauſe. If the blood poured out by an artery, is thrown into a very lax cellular ſubſtance, we can eaſily ſuppoſe, that its increaſe will not only be more rapid, but that the diffuſion of the tumor will for the ſame reaſon be much more conſiderable, than when the artery is immediately enveloped with firm membranous or ligamentous parts, which do not ſo readily yield to the impulſe of the blood. From this circumſtance alone, indeed, there is ſuch a difference in the progreſs of aneuriſm, that in ſome inſtances the tumor is many months, nay even years, in arriving at any conſiderable ſize; while in others the blood is ſo quickly poured out from the artery, as to be diffuſed over the whole limb in the ſpace of a few hours from the operation.

An unuſual degree of laxity in the cellular ſubſtance has undoubtedly much effect in promoting this rapid diffuſion of the extravaſated blood; but the practice of applying tight preſſure in wounds of arteries has, I am convinced, in all ſuch caſes, a very hurtful effect. In addition to what I judged it neceſſary to ſay upon this point in the Chapter on Blood-letting, I ſhall here obſerve, that if it was poſſible to make moderate preſſure upon the orifice in the artery alone, ſome advantage might perhaps be derived from it; but in applying preſſure to the artery of a limb, the correſponding vein muſt be all ſo much compreſſed, as to give much obſtruction to the return of blood from the artery. And whatever tends to obſtruct the refluent blood, muſt in the ſame proportion diſtend the wounded artery, and thereby increaſe the quantity of blood that eſcapes by the orifice. Many machines have indeed been contrived for compreſſing the artery without affecting the reſt of the limb: But however much theſe may have been extolled by their inventors, none have hitherto anſwered the purpoſe of compreſſing the artery alone, without at the ſame time obſtructing the circulation in the veins; inſomuch that much harm has in different inſtances been produced by all of them.

Whoever may wiſh to make uſe of theſe inſtruments, will find various forms of them in Heiſter's Syſtem of Surgery, and in the works of Dionis and Platner.

Mr Dionis, an eminent French practitioner, although he recommends the application of preſſure to wounds in arteries, yet relates a caſe which happened to a ſurgeon of his acquaintance, in which the bad effects produced by it were ſo ſtrongly marked, as muſt convince all who carefully peruſe it, of the general impropriety of this remedy.

A ſurgeon having in blood-letting opened an artery, the uſual method of applying tight compreſſion was immediately employed. By this the external diſcharg of blood was ſoon ſtopped : But blood continuing to eſcape from the orifice in th artery, it paſſed up towards the ſuperio part of the arm, which it filled to ſuch degree, that on the operation for the aneuriſm, which was ſoon found neceſſary, being performed, upwards of four pounds o coagulated blood was diſcharged from it and for this purpoſe it became neceſſar to lay the parts open along the whol courſe of the arm *.

When, again, compreſſion has not bee applied, unleſs an unuſual degree of laxity prevails in the ſurrounding parts, th ſwelling proceeds to increaſe in a mor gradual manner: In becoming larger, i does not, like the true aneuriſm, becom much more prominent; but rather ſpread and diffuſes itſelf into the ſurroundin parts: By degrees it acquires a firm conſiſtence; and the pulſation, which was a firſt conſiderable, becomes always leſs i proportion to this difference of conſiſtence,

and

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* Vid. Dionis's Courſe of Chirurgical Operations.

and to the increaſe which the tumor receives in ſize; inſomuch, that in large aneuriſmal ſwellings of this kind, the pulſation of the artery is ſcarcely to be perceived.

In the firſt ſtages of aneuriſm, if the blood thrown out from the artery lies deep, the ſkin preſerves its natural appearance, and does not change its colour till the tumor is much advanced. It frequently happens, however, that the blood is thrown out with ſo much violence at firſt, as to get into immediate contact with the ſkin; in which caſe the parts become inſtantly livid, as if tending to a ſtate of mortification. A real ſphacelus, indeed, has in ſome inſtances been induced where the extravaſation of blood was conſiderable, and where the means beſt ſuited for its removal have either failed or been omitted.

It muſt, however, be conſidered as very culpable neglect, to allow a patient, from this cauſe, to incur the riſk which always reſults from mortification; for the hazard ariſing from operating for an aneuriſm, is inconſiderable, when compared with the danger of an extenſive gangrene.

On the tumor becoming large, the patient, who at firſt did not complain of it, is now much diſtreſſed not only with ſevere pain, but with ſtiffneſs, want of feeling, and immobility of the whole limb: And theſe ſymptoms continuing to augment, if the tumor be not opened, the teguments at laſt burſt; and if the artery is large, and effectual means be not immediately employed for preventing it, death will ſoon enſue, in conſequence of the profuſe hemorrhagy which neceſſarily muſt ſucceed.

I enumerated various cauſes, as being frequently productive, under certain circumſtances, of the encyſted aneuriſm: We alſo meet with ſome variety in the cauſes of the diffuſed aneuriſm.

I. Violent bodily exertion may be conſidered, as I have obſerved above, as the moſt frequent cauſe of the rupture of arteries ſeated internally; but as theſe do not properly belong to a work of ſurgery, I ſhall not here conſider them further.

II. The corroſive matter of ſores and abſceſſes, by entirely deſtroying the coats of contiguous arteries, may in this manner produce the diffuſed aneuriſm.

III. The ſharp ſpiculæ of a fractured bone being puſhed into a neighbouring artery, have in different inſtances produced aneuriſm.

IV. Violent blows have been known to produce this kind of aneuriſm. This, however, can ſcarcely happen any where but on the head, where the arteries lie more expoſed than in other parts to the effects of this kind of injury, from their being here very thinly covered, and from a blow in this ſituation falling on the artery lying almoſt in cloſe contact with a firm hard body, the cranium.

V. If the arterial covering of an encyſted aneuriſm, ſhould ever burſt before the external teguments of the tumor, the blood contained in it would diffuſe itſelf into the contiguous parts; in which caſe, a real *diffuſed* aneuriſm would be formed. There is reaſon, however, to think that this ſeldom happens: So far as I have obſerved, the internal coverings of aneuriſmal ſwellings never burſt firſt. The tumor proceeds to increaſe in a gradual manner; and the teguments at laſt become ſo tenſe and overſtretched, that they loſe their tone entirely; the ſkin becomes ſoft and œdematous; in ſome inſtances, it becomes gangrenous; and in others, although it retains its natural colour, yet its uſual powers are as evidently deſtroyed as they uſually are in the laſt ſtage of mortification. In this ſtate, it generally remains for a longer or ſhorter period according to the ſtrength of the arterial pulſation below. At laſt, however, the ſkin begins to crack, and a thin ſerum oozes out; the edges of this ſmall fiſſure in the teguments gradually ſeparate; and the contents of the tumor having loſt a conſiderable part of their ſupport, the force with which they are impelled, by degrees becomes too powerful for the remaining coverings, which accordingly ſoon burſt, ſo as to diſcharge their contents externally, without any effuſion into the neighbouring parts.

I ſhould therefore ſuſpect, that authors, in writing on this point, have been miſtaken: The Encyſted, or True Aneuriſm, as it is termed, has been commonly ſuppoſed in its laſt ſtages to burſt internally, and thus to produce the diffuſed or falſe aneuriſm; from what I have ſaid, however, there is cauſe to preſume, that this is at leaſt a rare occurrence. The progreſs and termination of the encyſted aneuriſm, in every caſe that I have ſeen of it, has been nearly as I have juſt deſcribed it to be; not by the arterial ſac firſt burſting, but by a rupture of the external teguments after being much overſtretched; the blood being ſoon thereafter diſcharged outwardly, and not effuſed into the ſurrounding parts. As it has been alleged, however, by very reſpectable authors, that the reverſe of this has ſometimes happened, I could not here avoid to conſider it as one of the cauſes of diffuſed aneuriſm.

VI. The moſt frequent cauſe, however, of the diffuſed aneuriſm, are punctures with ſharp inſtruments, ſuch as ſwords, cutlaſſes, and the lancet; which laſt may be conſidered as the moſt frequent of any.

Under one or other of theſe heads, almoſt every circumſtance may be comprehended, that can ever tend to produce aneuriſmal tumors.

It has unfortunately ſometimes happened, that tumors of the aneuriſmal kind have been miſtaken for abſceſſes and other collections of matter, and their contents of courſe have been laid open by inciſion. The conſequences of this may be more readily conceived than deſcribed. With a view to prevent ſuch a dreadful occurrence, it would be a point of the higheſt importance in practice to have ſuch a ſet of diagnoſtic ſymptoms of aneuriſm ſet forth, as would with certainty determine the queſtion. In the commencement of the diſeaſe, it may, for the moſt part, be eaſily aſcertained: At this time, the pulſation in the tumor is commonly ſo ſtrong, and other concomitant circumſtances tend ſo obviouſly to point out the nature of the diſeaſe, that little or no doubt reſpecting it can ever occur: But, in the more advanced ſtages of aneuriſm, when the tumor has become large, and has entirely loſt its pulſation, nothing but a minute attention to the previous hiſtory of the caſe can enable us to judge of it with accuracy.

Thoſe ſwellings, with which aneuriſms are moſt likely to be confounded, are, ſoft encyſted tumors, ſcrofulous ſwellings, and abſceſſes containing either purulent or other matter, ſituated either immediately above, or ſo nearly in contact with an artery, as to receive the influence of its pulſation: When a tumor of this deſcription is nearly connected with a large artery, the pulſation which it receives from it is frequently ſo ſtrong and diſtinct, as to render it impoſſible, from this circumſtance alone, to form any juſt idea of its contents.

But there is one ſymptom, which, when connected with a ſtrong pulſation in the tumor, may always lead us to determine with certainty that the ſwelling is aneuriſmal, and it is this; the contents of the tumor being made eaſily to diſappear upon preſſure, at the ſame time that they return inſtantaneouſly on the preſſure being removed. But although the *preſence* of this circumſtance, when connected with other characteriſtic ſymptoms of the diſeaſe, may lead us to conclude, that a tumor is of the aneuriſmal kind, yet the *want* of it ought not to convince us that it is *not* an aneuriſm; for it frequently happens, particularly in the advanced ſtages of aneuriſm, that the contents of the tumor become ſo firm and compact, that no effect is produced upon them by preſſure. Upon the whole, therefore, as in many inſtances of aneuriſm, no certainty can be obtained of its real nature; in all ſuch caſes, practitioners ſhould lay it down as an eſtabliſhed ed rule, to proceed as if the tumor was in reality of the aneuriſmal kind. By adhering to this, they may perhaps in a few inſtances be deterred from opening tumors, which it may afterwards appear might have been laid open with ſafety; but any leſſer inconvenience which this may occaſion, will be much more than compenſated, if, even in a ſingle inſtance, a ſurgeon is ſaved from thoſe diſagreeable feelings which he muſt experience if he ſhould ever have the misfortune to open an aneuriſm inſtead of a collection of matter.

But it is in the trunk of the body only, it muſt be obſerved, or in the neck, axilla, upper part of the thigh or groin, that ſo much caution in the treatment of tumors of this doubtful nature can ever be neceſſary. For in almoſt every part of the extremities, and even in all acceſſible parts of the head, when a tumor of this deſcription has become large, the operation for the aneuriſm ſhould always be adviſed; for we are in all theſe parts poſſeſſed of a very certain method of preventing danger, namely, the application of the tourniquet in the extremities, and of preſſure with the fingers on the head.

In forming a prognoſis in caſes of aneuriſm, three important circumſtances chiefly require attention. The manner in which it appears to have been produced: The part of the body in which it is ſituated: And, laſtly, the age, and habit of body, of the patient.

If an aneuriſm has come forward in a gradual manner, without any apparent injury being done to the part, and without having ſucceeded to any violent bodily exertion, there will then be reaſon to ſuppoſe, that the diſeaſe depends upon ſome local debility of the artery in which it is ſeated, or perhaps of the whole arterial ſyſtem: In which laſt caſe, little or no benefit can enſue from any attempt that can be made; as the operation for the aneuriſm being performed near to the tumor, there would be reaſon to fear, that the ſame cauſe by which it was produced here, ultimately tended to produce ſimilar dilatations in other parts of the artery: Whereas, there is much cauſe to hope, if the tumor has been produced by a bruiſe, puncture, or other external accident, that the operation would not fail of ſucceſs, provided the circulation of the part be not altogether deſtroyed by the ligatures to be put upon the artery.

In the Varicoſe Aneuriſm, we may in general venture on a favourable prognoſis. In different inſtances, it has been found, that the tumor does not increaſe ſo rapidly in the varicoſe aneuriſm, as in other varieties of the diſeaſe; that as ſoon as it gets to a certain length, it does not afterwards acquire much additional bulk, and that any inconvenience produced by it may be borne with eaſe for a great number of years.

It is in this alone, I may obſerve, that we derive any advantage in the treatment of aneuriſm from the diſcovery of this variety of the diſeaſe: And a very important diſcovery it is; for by means of it a patient may be ſaved, not only from a very painful operation, but from the riſk which muſt always attend the deſtruction of the principal artery of a limb. When a varicoſe aneuriſm becomes ſo large as to excite much diſtreſs, the operation ſhould no doubt be adviſed; but as long as the inconvenience ariſing from it can be eaſily borne, the hazard which very commonly attends the operation, and which nothing but neceſſity ought to indicate, ſhould certainly be avoided *.

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* In Volume II. Art. xxxvi. of the London Medical Obſervations, two caſes are related of the varicoſe aneuriſm, by Dr Hunter. One of them at that time was of fourteen years ſtanding, and the other had ſubſiſted for five years, and no operation had been found neceſſary. And in Vol. III. of the ſame work, Art. xiii. a ſimilar caſe of five years' duration is related by Dr Cleghorn.

As it has been alleged by ſome that no advantage is derived from the diſcovery of this ſpecies of aneuriſm from their ſuppoſing that the uſual operation is as neceſſary in it as in any other variety of the diſeaſe; and as in different inſtances the operation has been put in practice even in the incipient ſtages of the varicoſe aneuriſm, where no real neceſſity, I think, could occur for it; it therefore

The ſite of the tumor is the next point of importance requiring our attention.

therefore becomes a matter of ſuch importance as to merit a very attentive inquiry: and it is with much ſatisfaction that I communicate the following facts, as they tend to eſtabliſh with certainty, that in the varicoſe aneuriſm, the uſual operation of obliterating the cavity of the artery, is ſeldom, if ever, neceſſary.

In a letter which I received from Dr Hunter, he ſays, "The Lady in whom I firſt obſerved the varicoſe aneuriſm is now living at Bath in good health; and the arm is in no ſenſe worſe, although it is now thirty-five years ſince ſhe received the injury." And the Doctor further obſerves, that he never heard of the operation being performed for the varicoſe aneuriſm, that was known to be ſuch.

In a letter from Dr William Cleghorn of Dublin, he ſays, that the caſe of varicoſe aneuriſm above mentioned, as related in the 3d volume of the London Medical Obſervations, remains nearly in the ſame ſtate as at the time that account of it was made out, which was at leaſt twenty years ago; only that the veins are rather more enlarged. The patient recovered, and the limb became nearly as ſtrong and ſerviceable as the other. The man has all along continued his buſineſs as ſhoemaker, and has lately recovered from a ſprain in the affected arm, which he received in lifting a heavy burden.

When an aneuriſm is ſo ſituated that no ligature or effectual compreſſion can be applied for putting a ſtop to the circulation, if the artery is large, there would be the utmoſt hazard in laying it open; as the patient might probably loſe more blood than his ſtrength could bear, before it could be ſecured. In aneuriſms, therefore, that are ſo ſituated, particularly on any part of the trunk of the body, on the neck, axilla, or groin, there can never be a good foundation for a favourable

In a letter from Mr Pott, whoſe opportunities for obſervation were great, he ſays, " That he has met with three different inſtances of this ſpecies of aneuriſm, and that the operation never became neceſſary in any of them."

Among other inſtances of varicoſe aneuriſm which have appeared here, a young man from Paiſley, who had the misfortune to meet with it ſeveral years ago, was examined by different ſurgeons of this place. The diſeaſe was clearly marked, and no operation was adviſed. In a letter from Mr William Hamilton, Profeſſor of Anatomy in Glaſgow, I am informed, that this man was lately ſerving in the Navy, where he undergoes great fatigue without any inconvenience from the aneuriſm, although it was then of thirteen years' continuance.

able prognoſis. In ſuch ſituations, indeed, the greateſt danger is always to be dreaded: For the force of the arterial pulſation would at laſt be apt to deſtroy the coats with which the tumor is ſurrounded; and in ſuch an event, the moſt fatal conſequences might enſue.

The ſucceſs of this operation muſt alſo prove doubtful in the ſuperior parts of the extremities: But in the inferior parts of the arms and legs, it may be performed with a very fair proſpect of ſucceſs, even on the principal arteries; for after the great artery of a limb has crept along the upper part of it, a number of ſmall branches are always ſent out, which by anaſtomoſing not only with ſimilar branches below, but by their means with the under part of the large artery itſelf, theſe, in the event of the common trunk from whence they ſprung being deſtroyed, come to dilate to ſuch an extent as to carry on the circulation in the inferior part of the limb much more completely than could *à priori* be expected. We would not naturally ſuppoſe, after the principal artery of a part has been obliterated, that the circulation would there be afterwards carried on with much force; and yet numberleſs inſtances have occurred, of the large brachial artery being completely deſtroyed by ligature, without being productive of much inconvenience to the parts below; and the ſame circumſtance has alſo happened, where the operation for the aneuriſm has been performed on the trunk of the great femoral artery *.

From

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* In one caſe, the operation for the aneuriſm was performed with the moſt complete ſucceſs, on the trunk of the femoral artery, about two hand-breadths from the groin, by the late Mr Thomas Hamilton, Profeſſor of Anatomy in Glaſgow. And what rendered this caſe more remarkable, was, that after the trunk of the large artery was ſecured with ligatures, it was neceſſary to perform the operation again upon a ſmall branch of an artery which had been wounded, even farther up than the principal trunk.

For ſome time after the operation, the limb remained colder than the other, and it was upwards of a week before any pulſation could be felt in the artery at the ankle. In two months from the operation, the wound was completely

From what has been ſaid, therefore, it muſt appear, that when an aneuriſm is ſo ſituated, that compreſſion cannot be applied ſo as to ſecure the patient from the loſs of much blood when the artery is laid open, the operation ſhould not be adviſed; and in ſuch caſes, the prognoſis ought certainly to be very unfavourable. But, whenever an aneuriſm, produced by external violence, is ſeated on any of the extremities,

pletely healed, and the circulation and heat returned; and in a ſhort time thereafter, the patient had ſo far recovered the uſe of his limb, as to be able to take very violent exerciſe.

Theſe particulars I thought it right to communicate, as the caſe of this patient is one of a few well authenticated inſtances, of this operation having been attempted on the femoral artery ſo near to its origin; and the ſucceſs attending it ſurely points out the propriety of the meaſure, in every aneuriſm, even of theſe parts, not evidently ariſing from general debility of the coats of the artery.

In Vol. III. Article xii. of the London Medical Obſervations, another inſtance is related of the operation for the aneuriſm having been performed on the trunk of the femoral artery, by Mr Burchal, ſurgeon in Mancheſter: the patient recovered, and the limb became nearly as ſtrong and as ſerviceable as the other.

ties, where we are ſure of commanding the circulation, the operation ſhould always be adviſed, as ſoon as there is cauſe to ſuſpect, that the tumor, if left to itſelf, might burſt, ſo as to endanger the life of the patient.

The ſucceſs of this operation, depending in a great degree upon the circulation afterwards going on in the under part of the member, our prognoſis ought, *cæteris paribus*, to be more or leſs favourable, according as the tumor is ſeated high or low on the limb. For the riſk of the circulation being hurt, is always in proportion to the height of the tumor: according as it is high or low, this riſk is always increaſed or diminiſhed.

But, laſtly, whether an aneuriſm has been produced by an external injury, o by internal diſeaſe, and whatever may b its ſituation, the habit of body and age the patient are circumſtances meriti particular attention in the prognoſis to formed of the probable event of an ope tion: In no operation, indeed, are the

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vantages derived from health and youth more conſpicuous than in this; for in the earlier periods of life, all the ſofter parts accommodate themſelves much more readily to every important change, than they ever do in the more advanced ſtages of life: In old age, all the animal fibres have acquired ſo much firmneſs and ſolidity, as to be rendered almoſt incapable of diſtention: This is particularly the caſe with the arterial ſyſtem, ſome parts of which often proceed to a ſtate of oſſification: So that at this period of life, we may readily ſuppoſe, that the ſmaller arteries are rendered incapable of that degree of diſtention neceſſary for ſupplying the want of the principal artery of a part, which in the more early periods of life, they might with eaſe have done.

This operation having been performed with various ſucceſs, even where the tumors were apparently ſimilar, both in ſituation and other circumſtances, various reaſons have been ſuggeſted to account for it. With ſome the operation has ſucceeded,

ceeded, even under circumſtances apparently more unfavourable, than with others where it failed. Thus it has proved ſucceſsful, as I have lately remarked, in the trunk of the femoral artery, while in others, it has failed when done in the ham: That is, in the former the circulation in the under part of the leg was ſtill preſerved, and the patients recovered; while, in the latter, where ſucceſs might more readily have been looked for, the limbs remained cold after the operation, no return of circulation took place, mortification at laſt was induced, and the patients died.

From this variety of ſucceſs attending it, we find very contradictory opinions held forth reſpecting this operation. While one condemns it, as ſeldom proving ſucceſsful, if it be not in the very extreme parts of a member; others aſſert, that it may be done even in the largeſt artery of a limb, and with great probability of ſucceſs.

This contrariety of opinion, however, may, I think, be explained, by what I have ſaid concerning the age and habit of body of thoſe on whom the operation is performed; for, to the different powers of diſtention with which the arterial ſyſtem is endowed at different periods of life, the good or bad ſucceſs with which it is attended, may, with ſufficient reaſon, be often aſſigned. So that, although it may fail in an old infirm perſon, even in the under part of the leg or arm, we ought not to be thereby deterred from adviſing it, even in much higher ſituations, where the patient is young and healthy.

It may alſo be proper to obſerve, that in the ham the operation is ſeldom done ſo well as in the thigh: The artery lies ſo deep in the ham, that it is taken up with more difficulty; by which a conſiderable quantity of blood is often loſt; the ſtrength of the patient is in this manner exhauſted; and hence he often ſickens and dies, when otherwiſe he might probably have recovered.

Having thus conſidered the uſual appearances and cauſes of aneuriſm, together with the grounds upon which a juſt prognoſis is to be formed, we ſhall now proceed to the method of cure.

SECTION II.

Of the Treatment of Aneuriſms.

PRESSURE has been indiſcriminately adviſed in Aneuriſm, not only in the beginning of the diſeaſe, but in its more advanced ſtages. In a former chapter, on blood-letting, as well as in ſome parts of this, this ſubject has already been noticed: To theſe I muſt now refer; and ſhall at preſent advert to ſuch points only as were not before conſidered.

In the diffuſed or falſe aneuriſm, preſſure has been adviſed, not only with a view to diſcuſs the tumor; but in order to produce a reunion of the wound in the artery: I have already made it appear, however, as preſſure in ſuch caſes cannot be applied to the artery alone, without at the ſame time affecting the veins; and as this, by increaſing the reſiſtance to the arterial pulſations, muſt force an additional quantity of blood to the orifice in the artery, that in this way it muſt often do harm.

But although preſſure ſhould never be adviſed in any ſtage of the diffuſed aneuriſm, yet in ſome periods of the encyſted aneuriſm, it may often be applied with advantage.

In the early ſtages of encyſted aneuriſm, while the blood can be yet preſſed entirely out of the ſac into the artery, a bandage of ſoft and ſomewhat elaſtic materials, properly fitted to the part, will often prevent an increaſe of the tumor; and, in ſome few inſtances, by the continued ſupport thus given to the weakened artery, complete cures have been obtained. In all ſuch caſes, therefore, particularly in the varicoſe aneuriſm, which I have already endeavoured to ſhew can ſeldom require the uſual operation, much advantage may be derived from moderate preſſure.

But although preſſure to a certain degree has frequently proved uſeful in encyſted aneuriſm, it ought never to be carried far; for tight bandages, by exciting reaction in the parts to which they are applied, inſtead of anſwering the purpoſe for which they were intended, have often the contrary effect. Moderate preſſure, therefore, is more eligible than a great degree of it; nor ought it ever to be employed but as an eaſy ſupport to the weakened parts.

While we thus, however, adviſe compreſſion, other means ought not to be omitted: The patient ſhould be kept upon low diet; if the pulſe is full, blood ſhould be taken; the bowels ſhould be kept open; and all violent exerciſe, particularly of the injured part, ſhould be carefully guarded againſt. In the latter ſtages of aneuriſm, when much tenſion and pain are induced, opiates prove uſeful; and often indeed are the only remedies from which we obtain relief.

This courſe of treatment applies to every aneuriſm for which the operation is not to be performed; whether this may proceed from the ſeat of the diſeaſe rendering it inadmiſſible, or from any other cauſe: In ſuch circumſtances, indeed, an eaſy ſupport by means of gentle compreſſion; a low diet in order to prevent a plethoric ſtate of the veſſels; repeated bloodlettings when plethora actually exiſts; a total abſtinence from exerciſe; and the uſe of opiates when indicated by pain; are the only remedies from which much benefit is ever likely to be derived.

Having thus pointed out the different remedies to be employed where the operation is not to be performed, I ſhall now proceed to deſcribe the operation itſelf, a meaſure that becomes neceſſary when the means recommended for the previous treatment of the diſeaſe have failed, or when the tumor has made much progreſs before proper aſſiſtance is procured.

Our firſt ſtep in this operation is, to obtain a full command of the circulation in the under part of the limb, by means of the tourniquet applied above.

This being done, the patient ſhould be ſo placed, that the diſeaſed limb, on being ſtretched on a table, may be of a proper height for the ſurgeon, who ought to be ſeated during the whole courſe of the operation. The limb being in this ſituation properly ſecured by aſſiſtants, an inciſion is now to be made with a ſcalpel through the ſkin and cellular ſubſtance, along the whole courſe of the tumor; and in order to enſure ſufficient freedom for the remaining ſteps of the operation, this external inciſion ſhould be carried at leaſt half an inch paſt each end of the tumor. No miſchief can enſue from the firſt inciſion being free and extenſive; and I have ſeen different inſtances of the ſurgeon, being much embarraſſed in the ſubſequent ſteps of the operation, by timidity or ill-judged lenity in this part of it.

This being done, the ſurgeon uſually proceeds in a ſlow cautious manner, diſſecting away one layer of the membrane after another, till the artery itſelf is laid bare. In this manner the operation is always tedious, for the thickneſs of parts with which the artery is covered, is often very conſiderable, by one layer of a membranous ſubſtance having formed after another, from the coagulable lymph of the blood contained in the tumor: but there is no real cauſe for this degree of caution, as the operation may be equally well performed, in a ſhorter ſpace of time, and with much leſs pain to the patient.

As ſoon, therefore, as the external inciſion of the ſkin and cellular ſubſtance is completed, a lancet ſhould be puſhed into the ſac, ſo as to make an opening ſufficiently large for admitting one of the fingers: This being done, the fore-finger of the left hand ſhould be introduced at the opening, when the ſac ſhould be cut from one end to the other, by running a probe-pointed biſtoury along the finger from below upwards, and afterwards from above downwards, ſo as to lay the whole cavity open.

The cavity of the tumor being thus laid open, all the coagulated blood is now to be taken out: For which purpoſe, a variety of ſcoops and other inſtruments have been invented, but no inſtrument anſwers this intention ſo well, and with ſo much eaſe to the patient, as the fingers of the operator.

The coagulated blood being removed, together with the membranous filaments uſually found in aneuriſmal tumors, the cavity of the ſac muſt now be dried with a ſmall ſponge, when the tourniquet ſhould be made perfectly ſlack, in order to diſcover not only the artery itſelf, but the opening into it from whence the blood collected in the tumor has all along iſſued. This being done, we are next to employ proper means for preventing any farther effuſion of blood into the ſac. Various means have been propoſed for this; but they are all comprehended in thoſe that follow:

I. Ligatures upon large arteries, having in ſome inſtances deſtroyed the circulation in the under part of a limb, it was long ago propoſed, on laying open the ſac, to endeavour to finiſh the cure, by applying a piece of agaric or dry ſponge to the orifice in the artery; and in ſome inſtances, vitriol and other aſtringents, were uſed for the ſame purpoſe.

II. Upon the ſame principle with this, namely, that of ſtill preſerving the circulation in the whole courſe of the artery, it was ſome time ago propoſed by Mr. Lambert, an eminent ſurgeon of Newcaſtle, to ſecure the orifice in the artery with the twiſted ſuture *. A ſmall needle being puſhed through the edges of the wound, they are then to be drawn together by a thread properly twiſted round the needle, in the manner I have adviſed when treating of ſutures †.

Theſe methods, however, are both liable to objections: In the firſt place, neither ſponge,

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* Vide London Medical Obſervations, Vol. II. Article xxx.

† Vide Chap. vi. ſect. v.

ſponge, agaric, nor any aſtringent with which we are acquainted, is poſſeſſed of ſuch powers to deſerve much confidence; for, although, in a few inſtances, they have put a temporary ſtop to hemorrhagies, they have ſeldom produced any permanent benefit. In almoſt every inſtance in which they have been uſed, the hemorrhagy has recurred from time to time, ſo as to prove highly diſtreſsful, not only to the patient, but to the practitioner; ſo that from this want of ſucceſs, little or no attention is now given to remedies of this claſs.

With regard to Mr Lambert's method of ſtitching the orifice in the artery, it is certainly an ingenious propoſal, and would probably, in moſt inſtances, put an effectual ſtop to all farther diſcharge of blood; but as it has hitherto been very ſeldom practiſed, farther experience of its effects muſt be obtained, before we can with propriety either receive or reject it. But if, in a matter of ſuch moment, reaſoning may be admitted, I would beg leave to obſerve, that two material objections occur to it. One is, that in almoſt every inſtance of aneuriſm, the artery lies at the back-part of the tumor; ſo that when all the collected blood is removed, there is ſuch a depth of wound, that it muſt be always difficult, and in many inſtances impoſſible, to perform this nice operation upon the artery, with that attention and accuracy, which, in order to inſure ſucceſs, it certainly requires. It has ſometimes, indeed, happened, that the artery has been found on the anterior part of the tumor, in which caſe, the orifice would no doubt prove ſufficiently acceſſible. This, however, is a rare occurrence, as in almoſt every inſtance of diffuſed aneuriſm the artery lies at the bottom of the tumor, the blood being collected between it and the common teguments; and accordingly I have ſeen ſeveral inſtances, in which, after the tumor was laid freely open, the artery was found to lie ſo deep as to render it impoſſible to perform this operation.

But there is another very important objection to this practice recommended by Mr Lambert. By introducing a needle through the ſides of the orifice, and drawing theſe together with a ligature, the cavity of the artery muſt undoubtedly be at that point much leſſened. Mr Lambert, indeed, in his account of the only caſe in which he performed this operation, acknowledges that the diameter of the artery was thereby diminiſhed. Now, the paſſage of the blood being thus contracted at one point, the impulſe upon that particular part muſt be very conſiderable: So that the very remedy employed for the cure of one variety of aneuriſm, muſt in all probability prove a powerful agent in inducing another; for the blood being thus obſtructed in its uſual courſe, there will be much hazard of a dilatation being produced immediately above the ſtricture from which an encyſted aneuriſm is very likely to enſue.

I muſt fairly acknowledge, however, that all I have advanced, proceeds from reaſoning alone, for, as yet, I cannot ſpeak of it from experience. But, if farther trials of this operation ſhall tend to ſhow that the objections which I have ſtated againſt it are not well founded, no one will be more ready than I ſhall be to adopt it; for, if theſe objections were removed, I ſhould conſider this operation as deſerving to be ranked among the moſt important improvements which in modern times ſurgery has acquired. In the treatment of aneuriſm by the common operation, if the principal artery of a limb is concerned, ſome riſk is always incurred, not only of injuring the parts below in a moſt material manner, but even of deſtroying them entirely, by depriving them of the quantity of blood neceſſary for their ſupport. Now, by Mr Lambert's improvement, an effectual ſtop is put to the farther evacuation of blood, while at the ſame time the circulation in the diſeaſed artery is preſerved; ſo that if farther experience of its effects ſhall evince, that the objections which I have ſtated againſt it are not well founded, it will deſervedly be admitted as an important improvement in the cure of aneuriſm *.

III. Neither of theſe methods being to be truſted, I ſhall now proceed to deſcribe the uſual method of performing this operation, and it conſiſts in obliterating the arterial cavity entirely with ligatures.

The artery being laid bare in the manner I have directed, and the coagulated blood carefully removed from the cavity of the tumor, on the tourniquet being made ſlack ſo as to bring the orifice in the artery into view, a probe ſhould be paſſed into it, with a view to raiſe the artery from the contiguous parts, ſo that the ſurgeon may be enabled with certainty to paſs a ligature round it without comprehending the contiguous nerves, which in general run near

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* Since the firſt editions of this Work were printed, this operation has been once performed in the Infirmary here; but although done with ſufficient accuracy and attention, it did not ſucceed; and before a cure could be obtained, it was judged neceſſary to perform the operation in the uſual way.

near to the large bloodveſſels of the limb. By this precaution, the nerves may be always avoided; by which much miſchief may be prevented, which otherwiſe would probably ſupervene. In aneuriſms ſeated in the ham, or in the uſual place of bloodletting in the arm, bending the joint of the knee or elbow, by relaxing the artery, renders this part of the operation more eaſy, than when the limb is kept fully ſtretched out.

The artery being thus ſeparated from the contiguous parts, a firm, waxed ligature muſt be paſſed round it, about the eighth part of an inch above the orifice, and another at the ſame diſtance below. More than this is commonly adviſed, but much harm has ariſen from the ligatures being paſſed ſo far from the orifice as is commonly done; for the riſk of loſing the benefit of anaſtomoſing branches muſt always be in proportion to the extent of artery included between the ligatures.

The eaſieſt method of introducing the ligatures, is by means of a blunt curved needle, of the form repreſented in Plate V. fig. 3. A common ſharp needle is uſually employed; but it does not anſwer the intention ſo well. Being ſharp in the point and ſides, it is apt to injure the contiguous parts; and when the common crooked needle is uſed with a ſharp edge on its concave ſide, there muſt even be ſome riſk of wounding the under part of the artery, as the needle in this ſituation can ſcarcely be introduced without being in contact with the coats of it. The blunt needle is not liable to either of theſe objections; and beſides, when of the form repreſented in the plate, it is more eaſily introduced than any of the needles commonly uſed in this operation. Of late a new inſtrument has been propoſed inſtead of it: A curved ſilver tube being paſſed beneath the artery, a probe, fitted to the tube, and previouſly armed with a ligature, is then puſhed through it, and the ligature drawn along with it: It proves to be, however, a much more complex method of anſwering the ſame purpoſe with the needle, and will never therefore be employed by thoſe who have uſed the other.

The ligatures being both paſſed, the upper one is now to be tied ſufficiently firm for compreſſing the ſides of the artery. By ſome, a ſmall bolſter of linen is inſerted between the artery and the knot, in order to prevent the artery from being cut. This, however, can anſwer no good purpoſe; for if the whole artery is not ſurrounded with the bolſter, it will be juſt as liable to be cut by the ligature, as if this precaution had been omitted: And beſides, as I have elſewhere had occaſion to remark, the ligature on arteries need never be ſo tight, as to incur the riſk of dividing them; much leſs preſſure than is commonly applied being ſufficient.

The upper ligature being thus finiſhed, before the knot is paſſed upon the other below the orifice, the tourniquet ſhould be untwiſted, in order to ſee whether any blood is diſcharged by the wound in the artery or not. If blood flows freely, it will afford a pleaſant proſpect of the ſucceſs of the operation, as it will ſhew, that the anaſtomoſing branches are ſufficient for carrying on the circulation in the under part of the limb. But although blood ſhould not be diſcharged at this time by the orifice, we are not, from this circumſtance alone, to deſpair of ſucceſs; for it frequently happens, that the operation ſucceeds, although no blood is diſcharged on the trial that I have adviſed.

But whether any blood ſhould be diſcharged by this trial or not, we ſhould not reſt ſatisfied with one ligature; for unleſs the ligature below the orifice is alſo tied, hemorrhagies may probably take place on the return of circulation to the under part of the artery: This precaution, therefore, ſhould never be omitted; it is eaſily done, and it renders the patient ſecure againſt all farther loſs of blood. After the knots are tied, the ligatures ſhould be cut of ſuch a length as to admit of their ends lying over the wound, ſo that when neceſſary they may be more eaſily withdrawn.

With a view to farther ſecurity, it has been adviſed to inſert other two ligatures quite contiguous to theſe, and to leave them untied, ſo that if either of the others ſhould happen to fail, its place may be immediately ſupplied.

There is not, however, any cauſe for this precaution, for, if the firſt ligatures are properly applied, they will not fail to anſwer the purpoſe; and in the event of one or both of them giving way, they can be eaſily renewed: We alſo have it in our power to render the patient ſafe againſt any ſudden diſcharge of blood, by leaving the tourniquet looſe upon the upper part of the limb, which it ought always to be for ſeveral days after the operation, ſo that, in the event of blood burſting from the wound, it may at once be ſecured.

The ligatures being completed, the tourniquet ſhould be made looſe; and if no blood is diſcharged at the orifice in the artery, we may conclude that the operation is properly performed.

The wound ſhould now be lightly co-
ered with a pledget of any emollient
intment; and a compreſs of ſoft lint be-
ig applied over the dreſſings, the whole
ould be ſecured with two or three turns
a roller above, and as many below the
ntre of the wound.

The patient being now laid in bed, the
mb ſhould be placed in a relaxed poſ-
re upon a pillow, ſo as to create the leaſt
oſſible uneaſineſs from the poſture in
hich it is placed.

As this operation is always tedious, and
xcites much pain and irritation, a full
oſe of laudanum ſhould be given imme-
iately after it is finiſhed. With a view
o diminiſh ſenſibility in chirurgical ope-
ations, I have in different inſtances given
piates about an hour before: With ſome,
his has evidently proved uſeful, but with
thers it has appeared to do harm; parti-
ularly in weak irritable conſtitutions, in
hich with any doſes I ever ventured to
ive, the patients appeared to be rendered
nore ſuſceptible of pain, than if no opiate

had been taken. Immediately after every operation of importance, however, a opiate ſhould be given, and repeated occaſionally, according to the degrees of pain and reſtleſſneſs which take place.

In ſome few caſes of aneuriſm, it happens, that the pulſe in the under part of the limb is perceptible immediately after the operation. This, however, is not frequent; for aneuriſm being more commonly met with at the joint of the elbow, as a conſequence of blood-letting, than in any other ſituation, and as it rarely happens that the brachial artery divides till it paſſes an inch or more below the joint, the trunk of this artery is therefore moſt frequently wounded; and, as the ligatures in this operation muſt obſtruct the paſſage of almoſt the whole blood going to the under part of the arm, there can be no reaſon to expect any pulſation at the wriſt, till the anaſtomoſing branches of the artery have gradually become ſo much enlarged, as to tranſmit ſuch a quantity of blood to the under part of the limb, as may be ſufficient for acting as a ſtimulus to the larger branches of the artery.

Immediately after the operation, the patient complains of numbneſs or want of feeling in the whole member; and as it commonly becomes cold, it ought to be kept properly covered. In ten or twelve hours from the operation, although the numbneſs may continue, the heat of the parts generally begins to return; and, in the courſe of a few hours more, all the under part of the limb is even apt to become preternaturally warm.

Although phyſiological diſcuſſions are not immediately connected with our ſubject, and although I ſhall not therefore enter on them often, yet I cannot here avoid to remark the clear proof which we derive from this operation, of the great dependence that one part of the human frame has upon another. The nerves we know to be the inſtruments of ſenſe and motion; but on being deprived of their uſual ſupport from the ſanguiferous ſyſtem, their influence is inſtantly leſſened.

Immediately after this operation, the want of feeling in the parts below the ligatures, is commonly great; and in proportion as the circulation takes place in the under part of the limb, the feeling never fails to return. If we could ſuppoſe the nerves of the parts below to be always included in the ligature with the artery, that numbneſs which ſucceeds to the operation might be eaſily explained; but I have known it happen when nothing but the artery was ſecured with the ligature: And beſides, although the knot upon the nerves would account for the immediate loſs of ſenſibility which ſucceeds to the operation, it would not ſerve to explain the return of feeling, on the circulation being reſtored; for the nerve being deſtroyed by the ligature, if the want of feeling originated entirely from this, in what manner could the return of blood to the part be ſuppoſed to act in reſtoring it?

In the mean time, the regimen and ſituation of the patients are points which require particular attention: He ſhould be allowed cordials and nouriſhing diet when low and reduced, and confined to a low diet, if his conſtitution is plethoric: The limb ſhould be kept in a relaxed poſture, and towards the end of the fourth or fifth day, if the operation is to ſucceed, a weak feeble pulſe is diſcovered in the under part of the limb; and as this becomes ſtronger, the patient in the ſame proportion recovers the uſe and feeling of the parts.

As ſoon as matter has formed about the ſore, which ſeldom happens 'till the fifth or ſixth day, an emollient poultice ſhould be applied over it, in order to ſoften the dreſſings, which ſhould then be removed. At this time, too, the ligatures might be taken away; but as their continuance for a few days longer can do no harm, it is better to allow them to remain till the ſecond or third dreſſing, when they either drop off of themſelves, or may be taken away with more ſafety. The dreſſings, which ſhould always be of the ſofteſt materials, being renewed every ſecond or third day,

according

according to the quantity of matter, the ſore for the moſt part heals eaſily; and although the patient may for a conſiderable time complain of numbneſs, and want of ſtrength in the diſeaſed limb, yet in moſt inſtances a very free uſe of it is obtained at laſt.

It will be readily ſuppoſed, that this termination is the moſt favourable that can poſſibly happen. In ſome inſtances, our ſucceſs is far from being ſo complete: Inſtead of a return of circulation, and of the feeling and uſe of the parts, they remain cold and inſenſible, and no marks of returning life are perceived. From a mere want of blood, therefore, mortification at laſt takes place; and as nature is here deprived of one of her principal agents for the removal or ſeparation of gangrenous parts, I mean the efforts of the ſanguiferous ſyſtem, the diſeaſe for the moſt part terminates fatally.

Whenever mortification, therefore, enſues, as a conſequence of this operation, if the patient ſurvives till a ſeparation takes place between the healthy and diſeaſed parts, amputation of the limb is then our only reſource.

That this operation, when performed upon the principal artery of a limb, ſometimes terminates in this manner, no practitioner will deny; but its doing ſo in ſome inſtances, does not warrant our rejecting it in all. The event of every capital operation is very uncertain; and in this, as in every other of equal importance, as we cannot in any caſe ſay with preciſion how it will ſucceed, ſo we are never to adviſe it where means of a leſs hazardous nature will anſwer: While, on the contrary, when theſe are found to fail, and the patient's life appears to be in danger, it ought without heſitation to be performed.

Among the numerous improvements which modern ſurgery has experienced, one of the moſt ingenious is a new method of operating for the cure of the popliteal aneuriſm, firſt propoſed by the late M John Hunter of London.

In operating for this variety of aneuriſm in the uſual way, the depth of the artery renders it both difficult and tedious; beſides which, from the artery being frequently diſeaſed for a conſiderable way above the ſeat of the aneuriſm, the operation is thereby apt to fail. With the view of avoiding theſe difficulties, the femora artery is ſecured, in the new operation about the middle of the thigh; by which when the operation ſucceeds, the tumor in the ham ſoon diſappears, and in the courſe of a few weeks, the patient recovers the uſe of his limb.

In performing the operation in this manner, the tourniquet ſhould be applied as near as poſſible to the top of the thigh; but not drawn tight, in order to preſerve the parts in their relative ſituations: An inciſion, four inches in length, is then made through the ſkin and cellular membrane, rather above the middle of th thigh, and croſſing the inner edge of the ſartorius muſcle in an oblique direction from above downwards. The ſartorius being brought fully in view, the edge of it muſt be raiſed where the pulſation of the artery is perceived through the faſcia by which it is covered. This is next to be divided to the extent of two inches, when the artery muſt be carefully ſeparated from the nerve and vein with which it is accompanied; and a broad waxed ligature of ſilk being paſſed round it, by means of a blunt-edged hook, a firm knot muſt now be tied on it; and the ligature being left out at the edges of the wound, they ſhould then be laid together, and the whole covered with a pledget of ſimple ointment.

On the patient being put to bed, a tourniquet ſhould be applied looſely on the upper part of the thigh, with the view of putting a ſtop to any unexpected hemorrhagy, and the limb ſhould be placed on pillows, raiſed to ſuch a height, that the thigh and leg may form an angle with the body, as well as with each other; in this manner, relaxing the muſcles, and particularly the ſartorius, as much as poſſible; care being alſo taken, during the firſt eight or ten days, to retain the limb ſteadily in this ſituation.

On the fourth or fifth day, the dreſſings may be changed; but the ligature ſhould not be drawn till the fifteenth or ſixteenth day, when in general it will come eaſily away. Till the end of the third week, the patient ſhould be kept in bed; nor ſhould he be allowed to uſe his limb with freedom for the ſpace of ſeveral months after the operation.

This is undoubtedly a very important improvement on the method of operating for the popliteal aneuriſm, but further experience of the effects of it alone can ſhew whether it will in general ſucceed or not; and till this ſhall be obtained, we muſt remain uncertain, whether this operation, or that of amputating the limb at the upper part of the thigh, will fall to be preferred;

red; for it is not that mode of conducting a cure which carries the beſt appearance, that ought to meet with our preference, but that which experience proves to be the beſt, in conſequence of its ſaving the greateſt number of lives.

CHAPTER X.

Of Affections of the BRAIN *from External Violence.*

SECTION I.

General Remarks on Affections of the Brain from External Violence.

AFFECTIONS of the Brain from external violence, often induce a very complicated ſet of ſymptoms; are attended with imminent danger, and give much embarraſſment to practitioners: Accordingly,

ingly, both with reſpect to the hazard with which they are attended, and the difficulty that we meet with in the cure, there is perhaps no claſs of diſeaſes to be compared with them. Wounds and bruiſes of the head, which at firſt exhibit no marks of danger, often induce a train of ſymptoms which elude the ſkill of the moſt experienced practitioner; and, without admitting of any mitigation, proceed to a fatal period, ending only with the death of the patient.

The very intricate nature of theſe affections has excited the attention of practitioners from the time of Hippocrates downwards; but although this branch of practice has received ſome important improvements, from the induſtry and obſervation of modern ſurgeons, yet it muſt be admitted, that much ſtill remains to be done in it. Authors of the laſt and preceding centuries have propoſed modes of treatment in affections of the head, which modern practitioners do not admit; whilſt in various points of importance, ſurgeons of our own times differ materially from one another.

This uncertainty which prevails with reſpect to the nature and treatment of theſe affections, proceeds from different cauſes, the principal of which appear to be the following.

I. The neceſſity of a ſound and entire ſtate of the brain for the purpoſes of life and health, together with the peculiar delicacy of its ſtructure, makes injuries which in other parts of the body would induce no danger, when inflicted on this organ productive of the moſt alarming conſequences.

II. The brain being ſurrounded with a firm covering of bone, it is always difficult, and in many caſes impoſſible, to obtain an exact knowledge of the nature of the caſe, and of the parts more immediately injured: Inſomuch, that while the attending ſymptoms often lead us to preſume that the brain has ſuffered, if no external marks of injury appear, we are frequently at a loſs to determine where the inſtruments neceſſary for the relief of the patient ſhould be applied: For this reaſon, we have not, perhaps in any inſtance, ſo much cauſe to regret our very limited acquaintance with diſeaſes, as in affections of the brain; in which, diſcoveries are often made upon diſſection after death, a knowledge of which, if obtained a day or two ſooner, might have put it in our power to ſave our patients.

III. The moſt material impediment to our ſucceſsful treatment of diſeaſes of this claſs, is the impoſſibility of obtaining an eaſy and free acceſs to the injured parts, even when we know with certainty where they are ſeated. For, the brain being on all ſides ſurrounded with bone, we can rarely accompliſh ſo extenſive an expoſure of the injured parts as the proper treatment of them requires.

IV. The manner in which diſeaſes of the head from external violence have been commonly deſcribed, has had ſome influence in rendering this part of practice perplexed and intricate. Till of late years, authors have attended more to the conſideration of the cauſes which induce diſeaſes of the head, than to the real nature and treatment of the affections themſelves: Occupied almoſt entirely in deſcribing the one, they have very univerſally paſſed over the other too remiſsly *.

Thus, the various contuſions and wounds to which the head is expoſed, have been particularly deſcribed; and every variety of fracture which can happen has been mentioned with a minute accuracy. The moſt trifling differences that can occur, have been diſtinguiſhed by particular appellations, and much ingenuity has been exerciſed in deſcribing the extent with reſpect to length and breadth, and every other circumſtance relative to the figure of a fracture; points of very little importance; and which, when ſo much inſiſted

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* The French authors upon this ſubject, were the firſt among the moderns who wrote upon it with preciſion. And among theſe, that judicious practitioner Monſieur Le Dran ſtands particularly eminent: I need ſcarcely obſerve too, that the public are much indebted to our countryman the late Mr Pott, for his valuable work upon this ſubject.

ſiſted upon, tend to perplex not only the younger, but even the more experienced, part of the profeſſion. Nothing, indeed, can ſet the impropriety of ſuch diſtinctions in a ſtronger point of view, than our obſerving daily that no advantage ever enſues from them. It is the effect which fractures of the ſkull and other injuries produce upon the brain, which we ought to conſider, and not their external appearances.

If indeed the effects produced upon the brain by a fracture of the ſkull could be determined by the ſize and figure of the fracture, it ought to be minutely deſcribed; but every practitioner knows that this is not the caſe. Fractures of the ſmalleſt ſize will in ſome inſtances produce the moſt dangerous ſymptoms, whilſt in others thoſe of the greateſt extent excite no alarming appearance. As long as it was imagined that the danger induced by fractures of the ſkull was in proportion to their extent and figure, we need not be ſurpriſed at the attention with which theſe circumſtances were conſidered; but now while we know that no advantage can be derived from diſtinctions of this kind, I ſhall not judge it neceſſary to dwell particularly upon them.

Theſe are the circumſtances which render the management of affections of the brain from external violence uncertain. In the ſubſequent part of this chapter I ſhall endeavour to point out the means beſt calculated to extricate this part of practice from ſuch uncertainty; but before proceeding to do ſo, it will not be conſidered as improper our giving a conciſe anatomical deſcription of the parts moſt apt to ſuffer from injuries done to the head; as by this the ſubject will be rendered more clear and intelligible.

SECTION II.

Anatomical Deſcription of the Brain and ſurrounding Parts.

THE brain and cerebellum, with their membranes the dura and pia mater, have for their protection a covering of bone, the Cranium.

The cranium conſiſts of eight bones, forming an oblong vault or box, flattened on the ſides by the ſuperior firmneſs of the lower part of the temporal bones, and by the conſtant action of the temporal muſcles: It is more capacious on the back part than before, the lobes of the brain being here more extenſive.

The bones of the cranium or ſkull, are, the frontal bone, the two parietal bones, the two temporal, the occipital, the ſphenoid, and ethmoid. The firſt ſix of theſe are ſaid to be proper to the ſkull, the two laſt being conſidered as common to it and the face. The os frontis forms all the anterior or fore part of the cranium, the oſſa parietalia the middle and upper part, and the os occipitis the poſterior part of it: The oſſa temporum form the lower part of the ſides of the cranium; and the ſphenoid and ethmoid bones form the centre, or what is commonly termed the baſis of the ſkull; but as theſe two laſt-mentioned bones lie ſo deep, as to be entirely out of the reach of any chirurgical operation, any injury to which they may be expoſed, muſt in almoſt every inſtance prove fatal.

The other ſix bones are connected together by joints or indentations, termed Sutures, which are five in number, the coronal, ſagittal, lambdoid, and two ſquamous.—The coronal ſuture extends over the head, from within a ſhort ſpace of the external canthus of one eye, to within an equal diſtance of the other on the oppoſite ſide of the head; and in its courſe, it ſerves to unite the frontal bone to the anterior edge of the two parietal bones.—

The ſagittal ſuture unites the parietal bones on the ſuperior part of the ſkull, by running almoſt in a direct line from the middle of the frontal bone to the middle of the os occipitis: In ſome inſtances this ſuture proceeds along the whole extent of the os frontis, and terminates immediately above the noſe, by which that bone is divided into two equal parts; and inſtances are mentioned of the occipital bone being divided in a ſimilar manner; but this is confeſſedly a rare occurrence.

The lambdoid ſuture, ſo called from its reſemblance to the Greek letter Λ, begins, where the ſagittal ſuture terminates, at the middle of the ſuperior edge of the occipital bone; and its two crura or legs ſtretching down to the baſis of the ſkull, ſerve to unite this bone to the poſterior edge of the two parietal and temporal bones. It is in the courſe of this ſuture, namely, the lambdoid, that theſe ſmall irregular oſſifications, termed oſſa triquetra, are moſt commonly met with. In ſome inſtances they penetrate the whole thickneſs of the bone; but in others, they are chiefly confined to the external lamella of the ſkull, being ſcarcely perceptible inwardly.

The laſt ſutures we have to notice, are the two ſquamous, which ſerve to unite the ſuperior part of the temporal bones to the under and correſponding parts of the oſſa parietalia.

In young people, theſe five ſutures are almoſt univerſally met with, and it is neceſſary that practitioners ſhould be well acquainted with their direction; but it is proper to obſerve, that in older ſubjects, ſome of them are often wanting. Inſtances are even recorded, in which all the ſutures were completely obliterated; bu this I believe to be a very rare occurrence The ſagittal and coronal ſutures, are thoſ that are moſt frequently wanting.

Various advantages, are derived fro the formation of the ſkull by ſepara bones; but that which we have partic larly to mention, is, that at the ſutures, a more direct communication, by means of bloodveſſels, takes place between the membranes of the brain and the teguments of the ſkull, than otherwiſe could have been the caſe; and by means of theſe ſutures, too, there is reaſon to ſuppoſe, that fractures will not ſpread ſo extenſively as if the whole cranium was formed of one bone only.

Some advantage is in this manner accordingly derived from the ſkull being formed of different bones; for in the early ſtages of life, while the bones are not firmly connected together, fractures do not ſo readily paſs acroſs the ſutures, as they afterwards do: But nature muſt ſurely have had ſome other intention in this mechaniſm, otherwiſe the more perfect adult would not probably be deprived of an advantage which the earlieſt period of childhood enjoys in greater perfection: and although I have ſaid, that the ſutures have evidently ſome influence in young people, of ſtopping the progreſs of fractures, their effect is evidently not conſiderable; for daily obſervation evinces, that fractures paſs from one bone of the ſkull to another, even while the ſutures remain in every reſpect entire; a circumſtance which every young practitioner eſpecially ſhould be aware of; for, from many obſervations to be met with in ſome of our older writers, we might be led to imagine, that fractures rarely if ever traverſe the ſutures, which however we frequently find them do.

The bones of the ſkull are, for the moſt part, compoſed of two lamellæ or tables, ſeparated by a kind of bony net-work, or cancelli, commonly termed the Diploë. The external table is every where conſiderably thicker than the internal, which is firm, compact, and more brittle than the other; which readily accounts for what we ſometimes meet with, a fracture and even a depreſſion of the internal table of the ſkull, while the external ſurface of the bone remains entire: But it unfortunately happens, that the diſcovery of this is ſeldom or never made, till it is too late to prove uſeful; I mean not till after the death of the patient.

In the directions given by authors for applying the trepan, we are commonly deſired to proceed with much caution in paſſing the inſtrument through the inner table of the ſkull, while we are told that no danger can enſue from proceeding quickly in the firſt part of the operation till the outer table and diploë are fairly penetrated. This however proceeds upon the ſuppoſition of the two tables of the ſkull, with the intermediate diploë, being at all times diſtinct and obviouſly marked. Now we know, that this is not the caſe; for the diploë becomes leſs with age, and in many inſtances it has been ſo completely obliterated as to take away entirely the appearance of two tables of the ſkull over all the upper part of the head: And beſides, in ſome parts of the ſkull, the diploë is naturally wanting, particularly in different parts of the os occipitis, owing perhaps to the preſſure produced upon this bone by the muſcles with which it is covered. It is alſo wanting at the under part of the os frontis, where the two lamellæ of this bone ſeparate immediately above the eye-brows, in order to form the two cavities of the frontal ſinuſes; whilſt in general it is more diſtinctly obſerved over all the ſuperior part of the frontal bone, and through the whole extent of the oſſa parietalia, than in any other part of the ſkull.

The external ſurface of all the bones of the upper part of the cranium, is in general ſmooth and equal, and this is alſo the caſe with the internal ſurface of the ſame parts of theſe bones, excepting the temporal bones and ſome part of the oſſa parietalia, in which ſeveral deep furrows are formed by the pulſation of the arteries of the dura mater. But although the upper part of the ſkull is commonly ſmooth, almoſt the whole under part of it is rugged and unequal. This inequality on the outſide ſeems to be calculated for the better attachment of the different muſcles which move the head; and on the inſide it ſerves the purpoſe of ſupporting the different parts of the brain and cerebellum.

Almoſt the whole of the occipital bone is very unequal both in its external and internal ſurfaces: this is likewiſe the caſe with all the inferior part of the temporal bones, and with the under part of the os frontis; ſo that none of theſe ſituations are ſo proper for the application of the trepan, as the more ſmooth and equal parts of the ſkull.

The ſkull is externally covered with the common teguments of the body, the ſkin, and cellular ſubſtance; with the frontal, occipital, and temporal muſcles, and an aponeurotic expanſion formed by a combination of the tendinous fibres of them all; and more immediately by the pericranium, a very ſtrong membrane, which adheres firmly to every part of it, but particularly at the ſutures.

It has by many been ſuppoſed, that the cavity formed by the bones of the ſkull, is not naturally completely filled. This, however, is now known to be an opinion void of foundation; for every part of this cavity is occupied by the brain and cerebellum, with their inveſting membranes the dura and pia mater.

The dura mater, which is a ſtrong inelaſtic membrane, adheres every where to the internal ſurface of the ſkull by an infinite number of ſmall vaſcular filaments, as is evident by thoſe innumerable points of blood which appear over the ſurface of this membrane, and through the whole internal ſurface of the ſkull, on the cranium and dura mater being forcibly ſeparated from each other. This adheſion, however, of the dura mater to the cranium, is much more firm at the ſutures than in any other part, owing to the bloodveſſels which paſs out here being not only more numerous, but of greater magnitude than in the reſt of the ſkull. In other parts of the head, any veſſels which paſs from the dura mater to the ſkull ſeem to be chiefly intended to ſupply the internal table, and the diploë, with blood; but at the ſutures an evident communication takes place, by means of bloodveſſels, bet-

ween the external coverings of the ſkull
nd the membranes of the brain, a circum-
ance which practitioners ſhould be aware
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wered by applying the inſtrument on any
ther part; and that, by the firm adheſion
f the dura mater to the ſkull at the ſu-
ures, matter or blood collected on the ſur-
ce of that membrane on one ſide of a
ture, will not be diſcharged by a perfo-
tion made on the oppoſite ſide of it.

The dura mater, the firmneſs of which
nders it particularly proper to ſupport
e brain by its different productions, is
too hard a texture to be immediately

connected with that very delicate organ. It is therefore every where lined with another ſoft membranous expanſion, the pia mater, which is immediately applied over the whole ſurface of the brain and its convolutions.

The great quantity of blood ſent to the brain and its coverings, is ſupplied by the carotid and vertebral arteries, and is again returned by the jugular veins; but before reaching theſe veins, it is emptied into a number of ſinuſes or reſervoirs, formed by productions or duplicatures of the dura mater: Theſe ſinuſes all communicate with each other: They are numerous on the back-part of the head, but the moſt material for ſurgeons to be acquainted with, are, the longitudinal, which runs along the middle and upper part of the head, directly in the courſe of, and firmly attached to, the ſagittal ſuture; and the two great lateral ſinuſes, in which the longitudinal ſinus terminates at the middle and upper part of the cerebellum, at which part theſe two ſinuſes commence, the one going to the right and the other to the left, and paſſing down to the baſis of the ſkull, they there terminate in the jugular veins.

This general account of the anatomy of theſe parts, will ſerve to render the conſideration of the injuries to which they are expoſed more clear and intelligible; while a more minute deſcription of them would not only be incompatible with the nature of this work, but would not in any reſpect be neceſſary; for the moſt minute deſcription that can be given of the different parts of the brain would be of no advantage to practitioners in the treatment of thoſe affections to which it is liable. We may, in general, obſerve upon this point, that the brain is an organ eſſentially neceſſary for life; and, that its parts cannot be deranged, either by wounds, contuſions, or compreſſion, but with the utmoſt hazard: For although we ſometimes meet with inſtances of the brain being much injured, and even of parts of it being diſcharged at wounds, without any important conſequences taking place; yet theſe are rare occurrences, and are by no means ſufficient to invalidate this general obſervation, that a ſound and entire ſtate of this organ is highly neceſſary for the purpoſes of life.

I ſhall now proceed to treat more particularly of the nature of thoſe injuries to which the parts that have juſt been deſcribed are liable; but inſtead of enumerating in ſeparate ſections, as has commonly been done, the various cauſes of affections of the head, and the ſymptoms which each of theſe excite; I mean to confider the general effects which they produce upon the brain, and to point out the manner in which they appear to operate, together with the means which from experience have been found to anſwer beſt in their removal.

All the ſymptoms of affections of the brain from external violence ſeem evidently to originate from one of the following circumſtances; namely, from compreſſion of the brain; from commotion or concuſſion; or from inflammation. Theſe I ſhall proceed to conſider in ſeparate ſections; and as far as the intricate nature of the ſubject will admit, I ſhall treat of them as diſtinct and unconnected with each other: For although we are not to expect that the ſymptoms ariſing from theſe different cauſes, are always diſtinct and preciſely marked, and without connection with each other; yet it frequently happens that they are ſo, and it is in their ſeparate uncombined ſtate only that any deſcription can be given of them. Practitioners of experience muſt indeed know, that cauſes frequently occur, by which all the affections of the brain that I have mentioned are induced at the ſame time in the ſame patient; and in ſuch inſtances, the ſymptoms which they produce are no doubt ſo very confuſed as to be with difficulty diſtinguiſhed: Thus, a ſtroke upon the head, attended with ſymptoms of concuſſion, is frequently accompanied with thoſe which proceed from compreſſion; and theſe again are in ſome inſtances ſucceeded by all the ſymptoms of inflammation.

The appearances induced by the various combinations of theſe, can be learned only from practice and obſervation; but an accurate knowledge of them as they occur in a ſeparate and unconnected ſtate, will prove highly uſeful in the cure, under whatever form they may occur.

SECTION III.

Of Compreſſion of the Brain from external Violence.

A Great variety of ſymptoms are enumerated by authors, as indicating a compreſſed ſtate of the brain from external injuries; but the moſt frequent, as well as the moſt remarkable, are the following: Giddineſs; dimneſs of ſight; ſtupefaction; loſs of voluntary motion; vomiting; an apoplectic ſtertor in the breathing; convulſive tremors in different muſcles; a dilated ſtate of the pupils, even when the eyes are expoſed to a clear light; paralyſis of different parts, eſpecially of the ſide of the body oppoſite to the injured part of the head; involuntary evacuation of the urine and fæces; an oppreſſed, and in many caſes an irregular,

gular pulſe; and when the violence done to the head has been conſiderable, it is commonly attended with a diſcharge of blood from the noſe, eyes, and ears.

Some of the milder of theſe ſymptoms, ſuch as vertigo, ſtupefaction, and a temporary loſs of ſenſibility, are frequently induced by ſlight blows upon the head: And as they often appear to be more the conſequence of a ſhock or concuſſion given to the brain, than of compreſſion induced upon it; ſo they commonly ſoon diſappear, either by the influence of reſt alone, or of the other means to be hereinafter pointed out. But when any of the other ſymptoms take place, ſuch as convulſive tremors,—dilatation of the pupils,—involuntary paſſage of the urine and faeces,—and eſpecially when much blood is diſcharged from the noſe, eyes, or ears, we may always conclude with a good deal of certainty, that much violence has been done to the brain, and that compreſſion in one part or another is induced upon it.

In the anatomical deſcription of the cranium and brain, I had occaſion to remark, that the cavity of the ſkull in a ſtate of health, is completely filled by the brain, no vacuity whatever being left between them: It therefore neceſſarily follows, that compreſſion of the brain will be produced by whatever tends to leſſen the cavity of the ſkull.

A diminution of the cavity of the ſkull may happen in various ways; by fractures attended with depreſſion of any part of the bones of which it is compoſed; by the forcible introduction of any extraneous body through both tables of the bone; and by the effuſion of blood, ſerum, pus, or any other matter. The ſame effect may be likewiſe produced by the thickening of the bones of the head, as ſometimes happens in lues venerea, and by water collected in the ventricles of the brain in caſes of hydrocephalus internus.

Theſe two laſt-mentioned cauſes, however, proceed from, and are connected with, diſeaſes which it is not our buſineſs in this place to conſider. The effuſion of pus or any other matter not evidently either blood or ſerum, muſt always be the conſequence of inflammation, and will fall to be conſidered in a different ſection; and as the introduction of extraneous bodies into the brain muſt always be attended with a fracture, and commonly with depreſſion of ſome part of the ſkull, the conſideration of the one is neceſſarily connected with that of the other. I ſhall now therefore proceed to ſpeak more particularly of fractures attended with depreſſion, and ſhall afterwards conſider the other general cauſe of compreſſion of the brain, effuſion of blood or ſerum.

§ 1. *Of Compreſſion of the Brain from Fractures attended with Depreſſion of the Skull.*

FRACTURES of the ſkull, as I have already obſerved, have been diſtinguiſhed by a variety of appellations according to their figure, extent, and other circumſtances of little importance: To retain theſe diſtinctions, could therefore anſwer no good purpoſe; and as it might embarraſs the younger part of the profeſſion, I do not mean to mention them.

The only general diſtinction of fractures neceſſary for us to retain, is, thoſe which are attended with depreſſion, and thoſe which are not. All the variety of the latter I mean to comprehend under the denomination of Fiſſures; but the conſideration of theſe will be more properly introduced in a different ſection.

Fractures of the ſkull may be produced in various ways: By falls from a height; by blows with ſharp or blunt inſtruments; and by miſſile weapons, ſuch as ſtones, and balls thrown from a diſtance.

Authors, who have entered minutely into this part of the ſubject, obſerve, that in the treatment of fractures, much advantage may be derived, from a knowledge of theſe circumſtances; and that we may even aſcertain with ſome preciſion, the degree of violence that has bee done to the brain, from being acquainte with the cauſe by which it was produced.

But although it is proper to inquire into the nature of the cauſe of every fracture, yet we are not to imagine that an material advantage will be derived from it: we know, indeed, that a fracture o the ſkull, produced by a blow with an obtuſe or blunt inſtrument, or by a fall from a conſiderable height, is frequently attended with more alarming ſymptoms than a fracture of the ſame extent with a ſharp inſtrument. This, however, is not univerſally the caſe; and as it is impoſſibl to aſcertain the extent of any injury don to the brain by this circumſtance alon little or no dependence ſhould ever placed on it.

In the management of fractures of ſkull attended with depreſſion, the i cations are,

1. To diſcover as exactly as poſſibl ſite, the courſe, and the full extent o fracture.

2. To obviate the effects of the injury done to the brain, by elevating or removing all the depreſſed parts of the bone.

3. To endeavour to complete the cure by the application of proper dreſſings, and attention to the after-treatment.

Theſe are the objects which we ought to have in view. In many inſtances, indeed, this is put out of our power by the nature of the fracture; but in others, when theſe indications can be accompliſhed, we are frequently able to afford more effectual relief to patients, than it is ever in our power to do in the treatment of any other malady.

In fractures of the ſkull, the teguments covering the injured part of it, are frequently cut, lacerated, or even altogether torn away. In this caſe, the ſtate of the bone is at once rendered evident; the fracture is immediately diſcovered, and the ſurgeon is left at liberty to employ the moſt proper means for obviating the effects of it: But when the ſkin and other teguments are entire, it often happens, even when, from a concurrence of circumſtances, we are tolerably certain of the exiſtence of a fracture, that we do not eaſily aſcertain it.

When any outward mark of injury takes place, particularly when a tumor is perceived on any part of the head, accompanied with appearances of a recent contuſion, the ſymptoms are commonly found to originate from a fracture directly underneath; and on the bone being laid bare, in the manner to be hereafter mentioned, the courſe of the fracture is in general diſcovered.

But every practitioner knows, that injuries done to the head frequently produce affections of the brain, and even fractures of the ſkull, without leaving either tumor or any other external mark by which they can be diſcovered. In this ſituation, the whole head ſhould be ſhaved, when it will ſometimes happen, that a particular ſpot will appear red, which could not be obſerved till the hair was removed, and will thus lead to a diſcovery of the injured part. But when no tumor, inflammation, or any other mark is diſcovered, we may in ſome inſtances be directed to the ſeat of the injury, by preſſing firmly over the whole head: and if we find, on repeated trials, that preſſure excites more pain in a particular part than in others; of which we may be convinced if the patient moans much on preſſure being applied to it, and if he puts up his hand or draws away his head; on this trial being repeated, we may conclude with much probability that this is the ſeat of the injury.

In circumſtances, ſuch as we are now conſidering, ſo fraught with danger to the patient, and ſo perplexing as they frequently are to practitioners, nothing that can throw light upon the nature of the caſe ſhould be overlooked. If the patient raiſes his hand, and applies it frequently upon or near to the ſame part of the head, even this will merit attention; for in this manner I have in different inſtances been led to the ſite of a fracture.

When therefore the ſymptoms of a compreſſed brain are evidently marked, we ought, without heſitation, to proceed to examine the ſtate of the cranium whereever appearances give cauſe to ſuſpect that a fracture has taken place. We do this by laying the bone bare by making an inciſion with a ſcalpel through all the external coverings of the ſkull.

In performing this operation, when the bone is previouſly found to be much injured, which in ſome inſtances is the caſe even where the ſkin directly above it is not lacerated, the inciſion through the integuments ſhould be made with caution; otherwiſe the brain may be hurt, either by the knife preſſing on ſome detached portion of bone, or even by the point of it paſſing in between two of the ſeparated pieces. But when the bone upon which the inciſion is made, is not either broken into different portions, or when the edges of the fractured pieces have not receded from each other, and do not in any degree yield to preſſure, the diviſion of the ſkin and other teguments may be then performed with freedom, by cutting through the whole of them down to the bone, with one ſtroke of the ſcalpel.

The ſole intention of this operation is to bring the injured parts of the bone into view; but although the means of effecting this ſhould be ſimple and eaſy, a very painful and ſevere method of doing it has been commonly practiſed.—It has been in general ſuppoſed, that in fractures of the ſkull, the injured parts cannot be ſufficiently expoſed, either for the purpoſe of tracing the courſe of the fracture, or for applying the trepan, unleſs a portion of the ſkin and other teguments is altogether removed: With this view, ſome have adviſed a crucial inciſion to be firſt made, and the corners to be cut off. Others recommend an inciſion of the form of the letter T: while by many we are adviſed to remove a circular or oval piece of the teguments at once.

Various objections, however, occur to all of theſe.—They not only produce a painful wound, which is commonly difficult to heal; but by expoſing a conſiderable part of the ſkull, tedious exfoliations ſometimes take place, which might be prevented; and the covering which nature afterwards provides for the denuded bone never anſwers the purpoſe ſo well as the teguments that were removed. Even all of theſe objections, however, to the practice that we are now conſidering, ſhould be conſidered as trifling, and ought not to be regarded, if we could not by more ſimple means diſcover the extent of fractures, and if we could not likewiſe by the ſame means apply the trepan, or any other remedy. But as both of theſe objects can perhaps in every inſtance be accompliſhed in a more eaſy manner, the other ought to be laid aſide.

On a ſimple inciſion being made in the manner I have directed, the teguments always retract ſo much as to admit of the bone being freely examined; and if a fracture is diſcovered, the courſe of it may be always traced with as much certainty by extending this inciſion along that part of the bone in which the fracture is found to run, as if a conſiderable portion of the teguments was removed: And this retraction of the divided parts alſo admits of the application of the trepan.

On the teguments being in this manner divided, if the ſkull is found to be fractured and depreſſed, the nature of the caſe at once becomes obvious; and the means to be hereafter pointed out for the treatment of fractures attended with depreſſion, ſhould be immediately employed. But even where no outward appearance of a fracture is met with, and where no tumor, diſcoloration, or other external mark of injury is diſcovered, if the patient continues to labour under ſymptoms of a compreſſed brain; if the pericranium has been ſeparated from the bone; and eſpecially if this membrane has loſt its natural appearance, and has acquired a pale white or duſky yellow hue; the trepan ſhould be applied without heſitation at the place where theſe appearances mark the exiſtence of an injury, for, in this manner alone, blood or ſerum, which may have been effuſed, and by which the compreſſion is induced, can be removed: It would, therefore, in ſuch circumſtances, be highly improper to truſt to the abſorption of the extravaſated fluids, as by ſome has been adviſed; the chance of a cure from this being very doubtful.

Again, although no mark either of fracture, or any other injury underneath, ſhould appear on the external table of the bone, ſtill it is poſſible that the internal table may be both fractured and depreſſed. This is not indeed a frequent occurrence, but yet various inſtances of it are upon record: I have met with it in different caſes; and other practitioners, on whoſe accounts we may place the moſt perfect confidence, likewiſe mention it.

I formerly obſerved that the internal table of the ſkull is thinner and more brittle than the external: how far this will explain the fact we have juſt been ſpeaking of, I will not pretend to ſay; but this is certain, that the injury done to the brain by the depreſſion of the internal table of the ſkull, may be as great, and may prove as certainly dangerous, as if the whole thickneſs of the bone had been forced in. This is therefore another motive for the application of the trepan in all caſes, accompanied with ſymptoms of compreſſed brain, even where no external mark of depreſſion is diſcovered.

It will often indeed happen, that no relief will be obtained from the application of the trepan, even where the ſymptoms are ſuch as proceed from a compreſſed ſtate of the brain, induced either by a depreſſed portion of bone, or by extravaſation of blood or ſerum. This want of ſucceſs from the operation, may proceed from a concurrence of cauſes that we ſhall afterwards have occaſion to mention: but the moſt fatal of all of them, is that which we term a contra-fiſſure, and the French a contre-coup;—in which the ſkull is fractured and ſometimes depreſſed, and blood or ſerum perhaps effuſed on the ſurface of the brain, at a part very diſtant from that which received the blow, and where alone there is any apparent or external mark of miſchief.

Many have doubted the reality of ſuch an occurrence; for, as we cannot clearly account for it, ſo it is alleged, that it has rarely, or perhaps never happened.—As it is not the intention of this work, to enter upon minute theoretical diſcuſſions, I ſhall not attempt to explain the manner in which contra-fiſſures of the cranium may be produced: I ſhall juſt ſhortly obſerve, that doubts concerning their exiſtence, can have been entertained by ſpeculative writers only; for every practitioner of experience muſt have met with opportunities to aſcertain the reality of the fact.

I will not pretend to ſay, that a blow received on one ſide of the head, will neceſſarily and certainly produce a fracture or other mark of injury on the oppoſite ſide; neither does it appear that the part exactly oppoſite to the place where the blow has been received, will ſuffer more readily than other parts of the head, at the diſtance of only two or three inches. All I wiſh to eſtabliſh is, that the ſkull may be fractured in parts not immediately contiguous to thoſe upon which blows are given; and that this ſometimes happens where no external mark can be diſcovered upon the teguments correſponding to the fracture, and while the bone remains perhaps entire on the part which more immediately received the injury.

We ſhall therefore conſider it as matter of fact, that the ſkull may be fractured in parts at ſome diſtance from thoſe which have more directly received an injury; and ſome advantage I think may derived from this being kept in view.—In common practice, if no benefit is reaped from the application of the trepan; if no fracture is diſcovered of the internal table of the ſkull, or no extravaſation on that part of the brain newly denuded by a removal of a piece of the bone; and if blood-letting,

ting, laxatives, and the other means uſually employed, do not remove the ſymptoms of compreſſion; practitioners very generally conclude, that they depend either on concuſſion of the brain, or on extravaſation in ſome of the internal parts of it, where the effects of an operation cannot reach; and accordingly, the patient is left to his fate, without any attempt being made for his relief.

In this, however, I think we are liable to much juſt cenſure and blame; For although a patient in ſuch circumſtances is undoubtedly in great danger, and although the chance of his recovering by any means we can employ, is inconſiderable, yet ſtill he ſhould receive this chance: In ſuch circumſtances, no attempt that we can make will add to his hazard, ſo that nothing ſhould be omitted from which there is the moſt diſtant chance of relief being derived.

The head ſhould be again examined with attention; and by preſſing firmly, ſlowly, and deliberately, over every part of it, if even the ſmalleſt degree of ſenſibility remains, the patient will complain, either by moan, or ſigns with his hands, when preſſure is applied to any part that is fractured. I have ſeen different inſtances of fractures being diſcovered in this manner, which, in the ordinary way of ſearching for them, had been altogether overlooked.

In whatever part of the head the patient complains on preſſure being applied to it, the ſkull ſhould be laid bare by an inciſion, in the manner I have mentioned. —If both tables of the ſkull are fractured and depreſſed, the cauſe of the miſchief will thus be diſcovered: But even although no ſuch depreſſion or fracture ſhould appear in the external lamella of the bone; as there is at leaſt ſome chance of miſchief being met with underneath, either from a fracture of the internal table, or from extravaſation, and as nothing can poſſibly ſave the patient but the removal of this, the trepan ſhould be immediately applied; and wherever there is the leaſt cauſe to ſuſpect, either from pain being induced by preſſure applied in the manner I have adviſed, or from any other circumſtance, that miſchief may be concealed, as long as relief is not obtained from what has previouſly been done, the operation ſhould ſtill be repeated, as the only means from whence any benefit can be derived.

This, however, leads to a point that merits more extenſive diſcuſſion; I mean, the effects produced upon the brain by the removal of a portion of the ſkull with the trepan.

By many of our older writers on this ſubject, it is ſaid, that much hazard is at all times to be dreaded from this operation; and in ſupport of their opinion, they not only adduce a variety of facts, but employ much ingenious reaſoning on the probable influence of the air finding acceſs to the ſurface of the brain, an organ which nature has taken particular pains to protect from it.

Practitioners of modern times, however, have adopted a very different opinion upon this point: They even aſſert, that no danger can ever accrue from the operation of the trepan conſidered abſtractedly; that it never proves hazardous of itſelf; and that it only apparently proves ſo from being often employed for the removal of ſymptoms for which this as well as every other remedy is altogether inadequate. In conſequence of this, the trepan, in all injuries done to the head, is applied with freedom; in moſt inſtances, probably with much propriety; but in others, I am convinced, with very dangerous conſequences.

My opinion on this important point is, that we ſhould endeavour to avoid both extremes. For, although I clearly think, that the trepan ſhould be applied with freedom wherever it is indicated by ſymptoms of a compreſſed brain, and where theſe ſymptoms muſt probably end in death, if the cauſe which produced them is not ſoon removed; yet I am equally ſatisfied,

tisfied, that it is the preſence of ſuch ſymptoms only which can warrant this operation; and that it ſhould never be employed, as it too frequently has been, merely with a view to prevent them.

In the one caſe, no additional riſk can be incurred by the trepan; and as the patient will in all probability ſuffer if it is not employed, we ſhould not heſitate to adviſe it: But, as I am perfectly convinced, from attentive obſervation of the effects of this operation upon the brain, that it is by no means an innocent remedy, and, on the contrary, indeed, that it is frequently the cauſe of dangerous ſymptoms, which otherwiſe would not have appeared, I would never think of adviſing it but for the removal of ſymptoms already induced; that are evidently of a dangerous tendency; and that cannot be obviated in any other manner.

In a ſubſequent part of this chapter, when treating of fiſſures, I ſhall again enter on the conſideration of this ſubject. In the mean time, before deſcribing the operation of the trepan, I thought it proper, in this manner, to mention the opinion I had formed of it.

Having thus conſidered the firſt general indication to be kept in view in the treatment of fractures attended with depreſſion of the ſkull, we now proceed to the conſideration of the ſecond, which comprehends the means beſt adapted for the removal or elevation of a depreſſed portion of bone. We have already had occaſion to ſee, that there is ſome variety in fractures attended with depreſſion; and the means employed for removing them, are likewiſe various.

It often happens, that the correſponding teguments are either altogether removed by the cauſe which produced the fracture, or ſo much lacerated as to admit of the bone being freely examined; but when they are either not divided in any part, or not in a ſufficient degree, the firſt object of the ſurgeon, as I have already obſerved, ſhould be, to get the head ſhaved, and then to divide the ſkin and other teguments with a ſcalpel through their whole extent, and directly upon the courſe of the injury. If a fracture is diſcovered, and is found to proceed in a ſtraight line, the inciſion ſhould have the ſame direction: Or if it takes an angular courſe, the inciſion ſhould likewiſe do ſo; for the ſole object of the one is to bring the other as completely as poſſible into view.

In making this inciſion, one or more arteries are apt to be cut, and they ſometimes continue for ſeveral hours to diſcharge freely; theſe, we are commonly directed, before proceeding further, to ſecure with ligatures.

If the patient is weak, or if a ſufficient quantity of blood has been already diſcharged, this ought no doubt to be done: But as the membranes of the brain are commonly much injured by the depreſſed bone, and as nothing in ſuch circumſtances tends with ſuch certainty to prevent inflammation, as a plentiful diſcharge of blood from the contiguous part; the arteries which have been cut by the inciſion ſhould be always allowed to bleed in proportion to the ſtrength of the patient, when they will commonly retract, and give no further trouble.

The hemorrhagy from the larger arteries being ſtopt, the remaining ſteps of the operation are commonly poſtponed till the following day, in order to have all the oozing from the ſmaller veſſels removed alſo: But as ſoon as the diſcharge from the principal arteries is over, that which takes place from the reſt of the wound ſhould not be regarded; and as it may always be eaſily ſtopped, by the edges of the cut being covered with dry lint, and moderately compreſſed by an aſſiſtant, and as the preſſure on the brain ſhould always be removed as quickly as poſſible, the operation ought therefore to be quickly completed.

The extent of the fracture being aſcertained as far as it can be done, and the blood from the inciſion ſtopped, we are next to endeavour to elevate the depreſſed portion of bone: the propriety of this, indeed, is ſufficiently evident, and it has been admitted by practitioners of every age, although they have differed much in the mode of effecting it.

Surgeons of the laſt and preceding centuries were in general timid in every operation of importance, eſpecially in ſuch as were performed upon the head: And being commonly averſe, as I have already remarked, to expoſe any conſiderable part of the brain, they endeavoured to elevate depreſſions of the cranium, either without penetrating the bone at all, or by means of very ſmall perforations only.

For the purpoſe of perforating the ſkull, a kind of circular ſaw, commonly termed a Trepan, and of which I ſhall give a delineation, was always employed; but the opening formed by it was ſo ſmall, that it was neceſſary to apply it often, even in ordinary caſes, to accompliſh the views of the operator: Many inconveniences enſued from this; to remedy which, various improvements upon this inſtrument were ſuggeſted, and figure 1. Plate VIII. repreſents the reſult of all of them. Thus improved, it removes a much larger portion of bone at once; and being entirely cylindrical, it penetrates the ſkull more eaſily than a conical ſaw, which, till of late was the only form in uſe.

In one circumſtance, however, modern ſurgeons have not made any improvement of this inſtrument: They have rather indeed hurt it materially, by forming it ſo as to render the operation of perforating the ſkull with it both more difficult and more tedious than it otherwiſe might be. The inſtrument delineated in Plate VIII. cuts the bone not only more quickly, but with equal ſafety. The timidity of ſome operators, however, has made them imagine, that it cannot be uſed of this form, but with the hazard of paſſing too ſuddenly through the bone at the end of the operation, by which the brain would be unavoidably injured: They have accordingly invented another, which divides the bone very ſlowly, and which they therefore ſuppoſe will perform the operation with more ſafety. This inſtrument is termed a Trephine, and is delineated in Plate IX. fig. 1. This, however, is not poſſeſſed of any advantage over the other, not even that of being more ſafe for perforating the bone; for, the ſame degree of force muſt be applied by the operator with each of them; and it has this very material defect, that it requires more than double the time to perform the ſame operation that is neceſſary with the trepan. It has long, however, been almoſt the only inſtrument employed for this purpoſe in many parts of Europe, eſpecially in Britain; ſo that prejudice may probably continue it in uſe: but whoever will attend to the principles on which the trepan and it are formed, will ſoon ſee that the former ſhould be preferred.

When it was neceſſary to perforate the ſkull, the trepan, in its then unimproved ſtate, was formerly the inſtrument chiefly employed. Others indeed were uſed for the purpoſe of forming openings in the bones; but they were ſo extremely rude and unmanageable, that it is not neceſſary

ceſſary to deſcribe them; and this eſpecially as delineations of all of them may be ſeen in the writings of almoſt every chirurgical author of the laſt and preceding centuries *. But, in many fractures and depreſſions of the ſkull, it was formerly imagined that the trepan was unneceſſary, as it was then generally believed that the depreſſed parts of it might be raiſed by more ſimple means: With this view, ſome writers propoſed to paſs a ſcrew in a ſlow and gradual manner nearly through both tables of the depreſſed bone, and then to raiſe it into the place that it formerly occupied, by pulling the ſcrew ſlowly and firmly upwards: And again in children, in whom the bones are more ſoft as well as more yielding, and in whom fiſſures are ſuppoſed to occur frequently without fractures, we were adviſed to cover all the teguments correſponding to the depreſſed portion of bone, with leather ſpread with adheſive plaſter, and then by means of

ſtrings

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* *Vide* the works of Hildanus, Scultetus, and Dionis.

ſtrings or cords fixed to the back part of the leather to elevate the depreſſion.

Whether a depreſſion ever occurs, however, even in early periods of life, without a correſponding fracture of at leaſt one of the tables of the ſkull, is much to be doubted. I rather think that it does not, at leaſt I never met with it: and I have ſeen different inſtances which previouſly were ſuppoſed to be ſuch, but which, after death, were all except one found to be attended with complete fractures; and in this the oſſeous fibres of the internal table of the bone were cracked or ruptured, while thoſe of the outer table remained nearly entire. But whether this kind of depreſſion ever occurs, or not, is not material: The means to be preſently pointed out for elevating depreſſions of the ſkull will prove equally uſeful, whether they are accompanied with fractures or not; while I may freely venture to ſay, that no dependence ſhould in either caſe be placed on adheſive plaſters, as they are evidently inadequate to the effect.

The powers of a ſcrew in raiſing depreſſed portions of the ſkull would often be ſufficient, but as it could neither remove any ſharp points of bone which might be beat in upon the brain, nor ſerve to diſcharge any diffuſed blood which frequently accompanies fractures attended with depreſſion, this means of removing depreſſed portions of bone will never probably be adopted. It has commonly, too, been objected to this inſtrument, that it cannot be introduced but with the hazard of forcing the depreſſed piece of bone upon which it is applied farther in upon the brain; and therefore that much miſchief may thus be induced by it.—In many inſtances, however, the ſcrew might be employed without hurting the brain; for the force neceſſary to paſs forward a ſcrew is inconſiderable; ſo that unleſs where a portion of bone is entirely detached from the reſt of the cranium, a ſcrew might frequently be inſerted into the depreſſed piece with little or no hazard of forcing it in upon the brain.

—If therefore the other objections that I have adduced to it were not material, the latter would not be of much importance. And as ſome practitioners may incline to have it in their power in particular inſtances to uſe it, I have thus thought it right to give an account of it.

I ſhall now proceed to deſcribe the practice of modern ſurgeons in fractures attended with depreſſion of the ſkull, together with ſuch improvements as the practice may appear to admit of.

The fractured part of the bone being brought into view by the diviſion of the teguments in the manner I have adviſed, and the flow of blood being likewiſe ſtopped, the exact ſituation of the depreſſed part of the bone next requires attention. In ſome caſes we find it entirely ſeparated from the reſt of the ſkull: In others, it adheres at one or two points: Whilſt in ſome, a fiſſure or rent is diſcovered, with one ſide of the bone beat down below the plane or level of the other.

When a portion of the ſkull is broken into ſeveral pieces, as they would never probably unite, either with one another, or with the ſurrounding bones, we are in general deſired to remove them: But when only one piece of bone is depreſſed, and eſpecially if this adheres at a point or two to the contiguous bones, practitioners often attempt to replace it, in order, as they ſay, to avoid that expoſure of the brain which the removal of a large portion of the ſkull muſt always occaſion; and they allege as a reaſon for this, that in ſome inſtances it ſucceeds, by the fractured and depreſſed piece uniting firmly with the contiguous bone.

It is not, however the unexpected ſucceſs attending the particular treatment of a few caſes by which we are to act: It is the reſult of general obſervation only by which our practice ſhould be determined. Whatever may have happened with a few, in their attempts to preſerve detached portions of the ſkull, practitioners of obſervation will allow, that more advantage is in general to be derived from removing them at once.

It univerſally happens, when one or more pieces of the ſkull are either entirely or nearly ſeparated from the reſt, that blood in a greater or ſmaller quantity is effuſed upon the ſurface of the brain, or on the dura mater, through the whole extent of the injury; ſo that, when a looſe portion of bone is allowed to remain, neither this extravaſated blood, nor the matter which afterwards forms, can find a free vent; while the piece that has thus been detached and replaced ſeldom or never unites to the ſurrounding bone: By the early removal of the detached portions of bone, every inconvenience ariſing from this is prevented; a free vent is thus given to any blood that may be preſently effuſed, or to the matter which may form in future; the ſtate of the dura mater, and even of the brain itſelf, may be freely examined; while inflammation and gangrene alſo, to which theſe parts are liable from fractures of the ſkull, are thus more effectually guarded againſt than they could be by any other means.

When the depreſſion is formed by different ſmall portions of bone, the whole of them may for the moſt part be eaſily taken out with common forceps; and by removing thoſe portions firſt, that appear to be moſt detached, the reſt will thus be looſened, and therefore more eaſily taken away. But it ſometimes happens, even when ſeveral portions of bone are beat in, and very commonly when the depreſſion is formed either of one piece entirely ſeparated, or of a portion of the ſkull forced in upon the brain without any of it being altogether detached, that the depreſſed pieces cannot be either removed, or even raiſed into a level with the reſt of the ſkull, in any other manner than by making one or more perforations in the contiguous ſound bone, for the purpoſe of introducing an inſtrument termed a Levator, with a view to elevate the depreſſion.

It is for this purpoſe chiefly that the trepan is employed: Hence it is evident, that this operation can never be neceſſary, when the depreſſed pieces of bone can be removed in the manner I have mentioned; for the ſole intention of it is thus accompliſhed in a more ſimple manner. But when the depreſſed portions of bone are ſo firmly attached to each other, that they cannot be elevated but with the *riſk* of wounding the brain or its membranes, which in fractures of the ſkull is very commonly the caſe, the trepan ſhould without heſitation be employed, and the following is the method of doing it.

In books of ſurgery, thoſe parts of the ſkull are commonly pointed out on which this operation may with ſafety be performed; and much pains has been taken to aſcertain thoſe that we ought to avoid. In practice, however, theſe limitations are ſeldom in our power to adopt, as the operation muſt always be performed near to the depreſſed portion of bone. But, as it appears from the anatomical deſcription that I have given of the different parts that may be concerned in this operation, that it may not only be performed with more ſafety in ſome parts than in others, but with more proſpect of advantage, practitioners ſhould be ſo far directed by this, as to avoid, as far can be done conſiſtently with the advantage of the patient, all thoſe parts from whence much riſk might enſue from a perforation being made in them. The parts which with this view we ſhould avoid, are, almoſt all the under part of the temporal and parietal bones; all the under part of the occipital bone; the inferior part of the frontal bone; and the whole courſe of the longitudinal ſinus. —The internal ſurface of the greater part of the two firſt of theſe bones are furrowed with the large arteries of the dura mater; a conſiderable part of the occipital bone is not only very unequal, but various ſinuſes lie immediately under it; the frontal ſinuſes lie in the inferior part of the frontal bone; and although we know that wounds of the longitudinal ſinus do not always prove fatal, yet as it tranſmits a large quantity of blood, we ſhould at all times endeavour to avoid it: But when the depreſſed pieces of bone are ſo ſituated as to render it impoſſible to raiſe them without applying the trepan over theſe parts, as the patient would in all probability die if the depreſſion was not removed, the trepan ſhould be employed without delay. We are not wantonly and unneceſſarily to perforate the ſkull where parts are ſituated which it might prove hazardous to wound; but when the life of a patient depends upon this operation, no practitioner, it is hoped, will ever decline it, when it is poſſible to perform it.

Of all the ſituations I have mentioned, the moſt inconvenient for the application of the trepan, is, the back part of the head upon the occipital bone, and the frontal ſinuſes immediately above the orbits. Beneath the former, ſeveral large ſinuſes are diſperſed, and both the external and internal ſurfaces of this bone are very unequal. And, again, the two lamellæ of the frontal bone are ſeparated ſo far from each other by the frontal ſinuſes, and the internal ſurface of the bone at this part is ſo very unequal, that no practitioner would make choice of it for the application of the trepan. But caſes ſometimes occur, in which it is neceſſary to apply the trepan in both of theſe ſituations. Wherever a fracture or any other cauſe of compreſſed brain is ſo ſituated that relief cannot be otherwiſe obtained, and where the patient muſt otherwiſe die, no difficulty ſhould deter us.—The muſcles of the occiput may be diſſected off from the part where the trepan ſhould be applied; and with care and attention, a perforation may be made even through the frontal ſinuſes.

The inſtruments in common uſe for this operation are the following: A Raſpatory for removing the perioſteum, repreſented in Plate VIII. fig. 3. A Perforator, Plate X. fig. 5. The Trephine itſelf, Plate IX. fig. 1. An inſtrument termed a Lenticular, Plate VIII. fig. 2.

Forceps, Plate IX. fig. 2. and an Elevator, repreſented in Plate XI. figures 1, 2, 3, and 4.

In proceeding to the operation, the patient ſhould be laid upon a table of a convenient height, with his head firmly ſecured by aſſiſtants: This being done, it is the common practice to lay a conſiderable part of the ſkull entirely bare round the part intended to be perforated. But this ought by no means to be done; for although it is neceſſary to remove as much of the pericranium as may admit of the head of the inſtrument being applied as frequently as it can be needed, yet more ſhould never be removed: tedious exfoliations of the denuded bone are apt to enſue from it; by which the cure is not only retarded, but much more hazard induced.

We are, therefore, either with a ſcalpel, or the raſpatory, Plate VIII. fig. 3. to ſeparate and remove juſt as much of the pericranium as will admit of the trepan being freely applied, and no more; and the part at which this ſhould be done, ought to be exactly at that point where the greateſt reſiſtance ſeems to be to the elevation of the depreſſed piece of bone. With the view alſo of deriving every advantage from the perforation, it ought to be ſo formed as to include not only the fracture or fiſſure, but if poſſible a ſmall portion of the depreſſed piece. The weight and preſſure of the inſtrument during the operation, ought no doubt to reſt chiefly on the ſound undepreſſed bone, as much injury might be done to the brain, by making it preſs much upon the depreſſed portion of bone: but it very commonly happens, that a ſmall ſegment of the opening may be made with perfect ſafety upon the depreſſed bone; and as the advantages that reſult from this in the ſubſequent ſteps of the operation, are conſiderable, it ought in every inſtance to be done.

The pericranium being removed, a ſmall hole ſhould be made in the undepreſſed bone, with the perforator, Plate X. fig. 5.

care being taken, as I have already obſerved, to have it ſo near to the fracture, that the head of the trepan may include a portion of the depreſſed piece. As ſoon as the hole is ſufficiently large for receiving the point of the pin in the centre of the circular ſaw, it ought to be inſerted into it, by which the ſaw is firmly preſerved in one place, till ſeveral turns being made with it, an impreſſion of a ſufficient depth is formed in the bone for retaining it, when the pin ſhould be removed: for by projecting paſt the edge of the ſaw, it might injure the membranes of the brain before the perforation is finiſhed; and as the ſole purpoſe of the pin is to fix the inſtrument during the firſt part of the operation, it becomes unneceſſary as ſoon as a cut is formed in the bone ſufficient for retaining it.

The ſurgeon ſhould now proceed to finiſh the perforation by preſſing on the inſtrument with moderate and equal firmneſs; for if more preſſure is applied to one ſide than another, the diviſion of the bone will be completed at unequal periods, which ought to be carefully guarded againſt. If the trephine is employed, all the force neceſſary for turning it is applied by one hand of the operator; the ſaw is made to cut by forming only a half circle or ſcarcely ſo much; and the perforation is finiſhed by moving the ſaw backward and forward, till the whole thickneſs of the bone is divided: But in uſing the trepan, the ſurgeon applies the preſſure upon the head of the inſtrument with one hand, while he turns the handle with the other. Some operators indeed make the preſſure with their forehead or chin; but it is both more eaſily and more equally applied with one hand. With the trepan the ſaw is made to move always in the ſame direction, by which it cuts more eaſily, and performs the operation in a third part of the time required with the trephine. When one perforation is ſufficient, this is not indeed an object of much importance; but as ſeveral perforations are not unfrequently neceſſary, and as the operation becomes thereby tedious, both to the operator and patient, that method of operating ought certainly to be preferred, which renders the means of cure more eaſy, provided it is equally ſafe. Now, it is obvious that the trepan is wrought with more eaſe than the trephine; and whoever has ſeen the operation done with both inſtruments, will confeſs that it likewiſe does it with equal ſafety: For in the hands of thoſe accuſtomed to uſe it, there is no more riſk of wounding the brain, by paſſing too ſuddenly in upon it with this inſtrument, than with the trephine. If the ſurgeon is cautious, there is no hazard of this with either of them; while, if not ſufficiently attentive, the trephine will produce as much miſchief as the other. Beſides, in uſing the trephine, the head of the patient is apt to be much jolted by the unequal motion of the inſtrument, by which much uneaſineſs is produced in the mean time, while it alſo ſerves to promote that tendency to inflammation in the membranes of the brain, that is apt in every inſtance to occur from a portion of the ſkull being forced in upon them.

Some practitioners, very ſenſible of theſe advantages of the trepan, but dreading the riſk of its paſſing too ſuddenly in upon the brain, commence the operation with this inſtrument, and finiſh it with the trephine*: This is far preferable to the uſual method of performing the operation entirely with the trephine; but thoſe who have fully experienced the advantages of the trepan, will employ it for the whole operation.

But whichever of theſe inſtruments are employed, the operator ſhould proceed with great ſteadineſs, and with as equal a degree of preſſure as poſſible till the perforation is finiſhed. For this purpoſe, the inſtrument ſhould be frequently taken out, and the depth of the cut examined by introducing

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* This, I believe, was firſt ſuggeſted by our preſent celebrated Profeſſor of Anatomy, Dr Monro, to whoſe ingenuity ſurgery, in many points of importance, is much indebted.

troducing the point of a probe or ſharp-pointed quill in the form of a tooth-pick: If the perforation has to go deeper in one part than in others, care ſhould be taken to alter the preſſure ſo as to carry on the cut of an equal depth to the laſt.

At each removal of the inſtrument, while the ſurgeon endeavours to diſcover the depth of the cut, and to clear it of blood and particles of bone, an aſſiſtant ſhould have the charge of cleanſing the ſaw with a ſmall bruſh; or, there may be two inſtruments with the ſaws exactly of the ſame ſize, ſo that while one is employed by the ſurgeon, an aſſiſtant may be cleaning the other.

When the inſtrument has reached the diploë, attention to the frequent cleanſing of the ſaw becomes more eſpecially neceſſary, as the blood diſcharged from this part of the bone, and from the ſpongy cancelli of which it is made, if not often removed, tends conſiderably to obſtruct the operation: But we ſhould not expect always to meet with the diploë; for it is wanting in ſome parts of the ſkull, and becomes leſs in every inſtance by age. The general direction, therefore, given for performing the firſt part of this operation freely and ſpeedily till the diploë appears, cannot with ſafety be admitted: Every ſtep of it ſhould be done, as I have ſaid, with ſteadineſs; but with ſuch caution, as to prevent every chance of the brain or its membranes being injured by the inſtrument being puſhed forcibly in upon them.

But if caution is neceſſary in the firſt part of the operation, it afterwards becomes much more ſo: So that in proportion to the progreſs of the ſaw, it ſhould be more frequently removed; and as ſoon as the point of a probe, or ſharp quill, can paſs entirely through at any part of the cut, the preſſure ſhould be removed from this point, and equally applied over the remaining uncut part of the bone. By proceeding in this cautious manner, the bone ſoon becomes looſe in different points; and on this being diſcovered, it may either be taken out with the forceps repreſented in Plate IX. fig. 1. or the points of two levators being inſinuated into the bottom of the cut formed by the ſaw, one on each ſide of the piece to be removed, it may in this manner be eaſily and ſafely taken away.

I here think it neceſſary to remark, that practitioners are apt to be too anxious about the total ſeparation of the piece of bone with the ſaw, before any attempt is made to remove it, from a fear of injuring the dura mater, if any ſplinter is left: That this may be avoided, they proceed with the ſaw till the bone is entirely ſeparated; and in order to bring it out with the laſt application of the inſtrument, the head of the ſaw, till lately, has always been of a conical form, by which the piece of bone is very commonly taken out along with it.

But, however plauſible theſe reaſons may appear, the practice ought not to be adopted; for it rarely or never happens, that the piece of bone taken out by the trepan is of an equal thickneſs in every part; ſo that if the ſaw is made to divide one ſide of it long after the other is cut, the dura mater immediately under the part that was firſt divided would be hurt by the teeth of the inſtrument, notwithſtanding all the caution that could be employed: Of this I have ſeen ſuch a number of inſtances, even in the hands of expert ſurgeons, that I have no heſitation in adviſing the practice to be avoided. In various caſes, indeed, where the operation has been ſuppoſed to be very properly performed, the mark of the ſaw has, after death, been evidently diſcovered on the dura mater over the whole circle of the perforation. Inſtead of proceeding with the ſaw, therefore, till the piece of bone is entirely ſeparated, it is always ſafer to force it out in the manner I have mentioned as ſoon as it is diſcovered to be looſe at different points; and even where ſome ſmall fragments or ſplinters of bone are left, no diſadvantage enſues, as they are eaſily removed with the common forceps, without hurting the dura mater *.

In addition to what I have ſaid of the form of the ſaw, I may remark, that the cylindrical ſhape is in every reſpect preferable to the conical, which in ſome parts of Europe is ſtill retained. I have already obſerved, that it is not by the form of the inſtrument that the dura mater and brain are to be avoided, but by proceeding through every ſtep of the operation with due caution; and while the conical ſaw is not neceſſary for removing

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* As the practice of taking out the circular piece of the ſkull entirely with the trepan, always appeared to me to be hazardous, I decidedly ſaid ſo in the firſt editions of this work. The ſame remark has probably occurred to others, and Dr Monro, I find, has long taken notice of it in his claſs.

With a view to prevent the brain from being injured, after the trepan has paſſed through one part of the ſkull, while the operator is employed in cutting the reſt, it has been propoſed by Dr Douglas, a phyſician of eminence in Kelſo, to have one of the heads of the trepan exactly the ſize of the others, but with teeth only on one ſide, by which the operation may be finiſhed with more ſafety than in the manner in which it is uſually done.

noving the piece of bone newly divided, t does not penetrate the bone with the ame eaſe as a cylindrical ſaw, neither is he piece which it takes out ſo large, nleſs the ſize of the inſtrument is much arger than any that has yet been employed.

This circumſtance, of the ſize of the opening made by the trepan, is an obect of much importance, and therefore merits particular attention. For, as the intention of perforating the ſkull, is to relieve the brain from a ſtate of compreſſion, produced either by depreſſion of the ſkull, or extravaſation of blood or ſome other fluid; as this is much more effectually done by a large than a ſmall opening; and as the pain and hazard of the operation are the ſame in both, a large opening ſhould always be preferred. The perforation made by the trepan ſhould never in an adult be leſs than an inch in diameter.

The piece of bone being removed, if any ſplinters or points are found to remain, they may be taken out with forceps, or with the lenticular, but the latter is ſeldom neceſſary: This being done, we proceed to the main object of the operation, and endeavour to raiſe the depreſſed portion of bone.

If the elevation of the depreſſed bone has been prevented, merely by being firmly wedged at one point; and if the trepan has been made to include this point, as it ought always to do, the whole piece, as it is thus entirely or nearly ſeparated from the reſt of the ſkull, may be now eaſily removed with the forceps; or if it ſtill adheres firmly at other parts, the trepan muſt be again applied at each of theſe before any attempt is made to remove it. But when the depreſſed portion of bone is not ſo much ſeparated from the reſt as to admit of being eaſily taken out, our next object is to raiſe it into a level with the reſt of the ſkull.——With this view, the point of a levator ſhould be introduced at the opening newly made, and being puſhed in below the edge of the depreſſed bone, if it be not firmly wedged in, it may be eaſily raiſed by moderate preſſure on the other end of the levator. But when the depreſſed piece is either of conſiderable extent, or gives much reſiſtance at one or more points, before any attempt is made with the levator, the trepan ſhould be applied again wherever it may appear to be neceſſary; and by a proper uſe of the levator at theſe different openings, it will then be eaſily raiſed.

The levator in common uſe, is not the inſtrument that I wiſh to recommend: For being made to reſt on the oppoſite ſide of the perforation, all the preſſure employed for elevating the depreſſion falls on the contiguous parts of the ſkull, by which much violence is often done to it; and as the ſame intention may be accompliſhed in an eaſier manner, the other ſhould be avoided.—By fixing the levator on a pin, ſupported by a ſmall frame upon two feet, and this frame being placed at a proper diſtance from the wound, the preſſure which it makes, falls on a ſound part of the ſkull, by which no harm can be done by it, while, from its ſimplicity of conſtruction, it is eaſily applied, and readily moved from one part of the head to another. The inſtrument to which I allude is nearly the ſame with the levator of the celebrated Mr Petit of Paris, and it is repreſented in Plate XI. fig. 2.

As the great object of this operation is to remove the depreſſed portion of *ſkull*, together with every other cauſe of compreſſion that is met with, I have taken different opportunities of pointing out the neceſſity of this being kept always in view. For if any portion of bone is overlooked, and ſhould be allowed to continue to preſs upon the brain, little or no benefit would enſue from the reſt of the operation; the patient would continue in nearly the ſame degree of hazard; and after death, the operator would be highly mortified to find, that with further attention, the life of his patient might probably have been ſaved.

At the ſame time that care is thus taken to elevate the depreſſed pieces of bone, the removal of any blood or ſerum from the ſurface of the dura mater, is equally neceſſary; and if any ſharp-pointed inſtrument, pieces of ſtone, or other extraneous bodies, have been any where forced in upon the brain, I need ſcarcely obſerve, that theſe muſt likewiſe be removed; and this being done, the ſore ſhould be immediately dreſſed, and the patient laid to reſt.

We meet with much variety in the directions given both by ancient and modern practitioners for the dreſſing of ſores after this operation. With a view to preſerve the dura mater and brain from mortification, various antiſeptic applications have been recommended, and doſſils or ſyndons covered with ointments are deſired to be introduced, not merely into the perforation formed by the ſaw, but to be preſſed as far as poſſible in between the ſkull and dura mater. The impropriety, however, of this, muſt at once appear obvious from the ſlighteſt attention to the effects of it. The ſole object of the operation is to remove compreſſion from the brain; now the dreſſings that I have mentioned, namely, doſſils of lint crammed into the different perforations, muſt evidently counteract this, not only by the preſſure which they produce, but by ſerving to prevent that free diſcharge of matter after the operation, upon which the ſafety of the patient in a great meaſure depends. Inſtead of this, the dreſſings ſhould be of the mildeſt kind, and as looſely applied as poſſible.—Dry lint is commonly employed; but it excites leſs irritation, and is more eaſily removed, when thinly ſpread with a ſimple liniment of wax and oil; and no detriment enſues, as ſome have imagined, from the application of unctuous ſubſtances to the brain. No tent or doſſil, as I have juſt obſerved, ſhould be inſerted into the perforation; all that is neceſſary is to apply as lightly as poſſible over the ſore, a pledget of ſoft lint ſpread with an ointment ſuch as I have mentioned;

tioned; and this being covered with a thin cuſhion of ſoft tow, the whole ſhould be retained with a common nightcap, made ſo as to tie below the chin, to be either pinned or tied of a proper tightneſs, on the fore or back part of the head. —This ſupports the dreſſings with ſufficient firmneſs; and it neither keeps the head too tight, nor prevents a free flow of matter from the ſore, an inconvenience very apt to occur from the uſe of thoſe bandages commonly employed after this operation.

The patient, on being removed to bed, ſhould have his head placed in ſuch a manner as to prevent the ſore from being hurt; while his poſition ought alſo to be ſuch as will moſt effectually tend to diſcharge any matter that the ſore itſelf may afford, or any blood or ſerum that may ooze from the ſurface of the dura mater.

When the ſymptoms under which the patient has laboured have ariſen entirely from a depreſſed portion of bone, and when this depreſſion has been completely removed, we commonly find that immediate relief is derived from the operation. From being perfectly torpid, with a deep laborious breathing, and a conſiderable dilatation of the pupils, the patient becomes leſs ſtupid and lethargic. He begins to toſs about in bed,—to raiſe his eye-lids,—and to make ſome feeble attempts to ſpeak: His breathing becomes leſs oppreſſed, and the pupils contract when expoſed to a ſtrong light.—But although all theſe favourable circumſtances do not appear immediately after the operation, we are not to deſpair of ſucceſs; for when the brain has been long compreſſed, it does not always recover its functions immediately on the cauſe being removed by which the compreſſion was produced: And, beſides, it often happens, that together with a fracture and depreſſion of the ſkull, the brain has received a violent ſhock or concuſſion; in which caſe, as the ſymptoms do not depend entirely on the compreſſed ſtate of the brain, ſo it is reaſonable to ſuppoſe, that other means muſt be neceſſary for their removal, after every cauſe is taken away by which compreſſion could be produced: With the aid of theſe, which hereafter we ſhall have occaſion to conſider, the moſt alarming ſymptoms are frequently removed at laſt, which reſiſt for a conſiderable time the moſt powerful remedies we can employ.

A ſurgeon ought not therefore to imagine that all his buſineſs is over when the operation is finiſhed; for this may be done in the moſt complete manner, and yet the patient will certainly die unleſs other means are employed for his relief: When the ſymptoms for which the trepan was applied, become leſs violent on the depreſſion of the ſkull being removed, and if the patient in the courſe of a few hours becomes ſtill more relieved; there will be much cauſe to hope that he will recover without any other remedy being employed; and that quietneſs, keeping an open belly, and avoiding every cauſe of inflammation, will at laſt prove ſufficient for the cure: But when the reverſe of this takes place, when the ſymptoms remain equally formidable after the operation as they were before, and eſpecially if they do not become more moderate in the courſe of a few hours after the patient is laid to reſt; remedies of a different kind become neceſſary.

As the ſymptoms which in ſuch circumſtances are moſt to be dreaded, originate from two different cauſes, and as the choice of remedies to be employed for its removal ſhould depend entirely on its real nature, it ought in every inſtance to be aſcertained with as much accuracy as poſſible.

The cauſes to which I allude, are, inflammation of the membranes of the brain, and concuſſion of the brain itſelf.

In general, the ſymptoms which prevail here, are all ſuſpected to proceed from the ſame cauſe; they are ſuppoſed to be entirely of the ſame kind, and the ſame ſet of remedies are therefore commonly employed in the cure. The impropriety of this, however, is obvious: For although it often happens, that the ſymptoms

toms are of a mixed nature, and depend ſo much on a concurrence of both the cauſes I have mentioned, that they cannot be rightly diſtinguiſhed, yet in various inſtances it is otherwiſe; and when an evident diſtinction is perceived, much advantage will accrue, from practitioners directing their attention towards it.

After all the evident cauſes of compreſſion are removed, if the pulſe is ſlow and ſoft, if the patient remains torpid, and eſpecially if the pupils do not contract on expoſure to a ſtrong light, there will be much cauſe to ſuſpect that commotion or concuſſion of the ſubſtance of the brain has taken place: For although all of theſe ſymptoms are occaſionally induced by a compreſſed ſtate of the brain, yet we know that they are likewiſe the frequent conſequences of concuſſion: So that, when all the depreſſed bone and other obvious cauſes of compreſſion are removed, we conclude with much probability, that any ſymptoms which remain, when they are ſuch as I have mentioned, depend more upon concuſſion than on any other cauſe.

But when, inſtead of theſe ſymptoms, there is, along with ſome return of ſenſibility, as is indicated by the patient's becoming unmanageable, and often moving from one part of the bed to another; if the pulſe is firm, full and quick; if the eye is found to be inflamed, and eſpecially if the pupil is obſerved to contract more than uſual, and the patient to withdraw his head on the eye being expoſed to much light; there will be much cauſe to ſuſpect that inflammation of the membranes of the brain has taken place. Indeed the dura mater, like every other membrane, is ſo ſuſceptible of inflammation, that it is difficult to imagine how any part of the ſkull can be beat in upon it, without irritating and inflaming it in a remarkable degree; and if once inflammation is induced upon part of this membrane, we know from experience that it readily and quickly extends over the whole of it; a circumſtance that eaſily accounts for the high degree of inflammation, which is often obſerved in the eyes, as likewiſe for the contraction of the pupils, and ſevere degree of pain which expoſure of the eyes in this ſituation to much light never fails to produce.

When the ſymptoms proceed from inflammation alone, the pulſe, as I have obſerved above, differs materially from the pulſe of a perſon ſuffering merely from concuſſion of the brain. In a ſtate of concuſſion, the pulſe is full, ſlow, and ſoft; but when inflammation takes place, the pulſe, although frequently full, has a firmer ſtroke, and is commonly quick and hard: And in this caſe the breathing, although not oppreſſed and laborious as it frequently is when the brain is compreſſed, is always more frequent than natural; a circumſtance not commonly obſerved in patients labouring under the effects of concuſſion.

Although, for the reaſons that I have given, it may often be difficult or even impoſſible to mark the exiſtence of theſe different ſets of ſymptoms, yet an attentive obſerver will frequently be able to diſtinguiſh them; and whenever it can be done, much advantage may be derived from it.

Practitioners of every age have adviſed in injuries done to the head, to diſcharge a good deal of blood; and there is reaſon to think that no general rule had ever a better foundation: But from attentive obſervation of the effects of blood-letting, I have cauſe to imagine that ſurgeons of modern times frequently carry it too far. Where the membranes of the brain are really inflamed, the propriety of diſcharging much blood is obvious, and will not be diſputed; but whenever there is reaſon from the nature of the ſymptoms to imagine that they proceed from concuſſion, blood-letting, if recommended at all, ſhould be practiſed with much caution.

Although the general ſtructure of the brain with reſpect to its figure, ſize, and other circumſtances, has long been well known; yet it muſt be confeſſed, that our anatomical knowledge of this organ is ſtill very deficient, nor have we the moſt diſtant idea of the manner in which it performs its various functions. Indeed our knowledge of this part of anatomy is ſo very lame, that we are frequently perfectly unable to diſcover, by the moſt minute diſſection, any difference between the brain in its ſoundeſt ſtate, and that ſtate of it in a perſon evidently killed by a fall or blow upon the head, and in whom all the ſymptoms induced by the accident were ſuch as indicated an affection of the brain alone. This is particularly the caſe in thoſe who die from what is termed Concuſſion or Commotion of the Brain. In ſuch inſtances the brain we ſuppoſe to be ſomehow or other deranged; but it moſt frequently happens, that the moſt accurate diſſection cannot diſcover the nature of this derangement, nor in what it conſiſts.

From this it is obvious, that the effect of concuſſion of the brain is not an excitement of inflammation; for every ſtage of inflammation becomes obvious to diſſection, and can ſcarcely indeed eſcape notice. Now, as it often happens in thoſe whom we ſuppoſe to have died from concuſſion, that no appearance of inflammation in any part of the brain is diſcovered, it is not unfair to conclude, that the effects of theſe two cauſes, inflammation and concuſſion, are diſtinct, and perhaps very oppoſite in their nature and effects.

From the circumſtances I have mentioned of the effects obſerved upon diſſection to ariſe from theſe cauſes, and of the ſymptoms induced by the one being different from thoſe which ariſe from the other, the concluſion I have formed with reſpect to their difference, might even upon theſe grounds be ſuppoſed to be well founded: But it is not on ſpeculation alone, that I wiſh to reſt either this or any other opinion of practical importance. The idea was firſt ſuggeſted by the different effects which I had obſerved to proceed from blood-letting in affections of the brain produced by external violence. In many, great advantages enſued from it, while no benefit was procured from any other remedy: But in others, inſtead of benefit being derived from it, the patients became obviouſly worſe after every repetition of the operation. The pulſe, from being full, gradually became weaker; and the ſtrength of the patient commonly ſinking in the ſame proportion, he ſeldom recovered from the effects of blood-letting, whenever it was practiſed to any conſiderable extent.

From theſe circumſtances I have been led to think, that concuſſion of the brain operates upon the ſyſtem, in nearly the ſame manner with ſyncope induced by fear, inanition, or any ſimilar cauſe, in the treatment of which, blood-letting is known to prove hurtful.

In what manner a blow upon the head or a fall from a height, in a full habit of body, and in a perſon otherwiſe in perfect health, who only a few minutes before could have ſupported the loſs of much blood, ſhould be able inſtantly to induce ſuch a ſtate of the ſyſtem as cannot admit of this evacuation, I will not pretend to ſay: But that it frequently happens, I am now from repeated obſervations entirely convinced; and whoever pays due attention to this branch of his profeſſion, will find that it is ſo. He will find, indeed, that all ſuch ſymptoms as ariſe from inflammation, are more effectually relieved by blood-letting than any other remedy: But he will for certain obſerve, that all of thoſe which do not depend upon this cauſe, and which ariſe ſolely from concuſſion, inſtead of being relieved by this remedy, will be uniformly rendered more obſtinate and more alarming, in proportion to the quantity of blood that is taken away.

So far, however, as my experience goes, the evacuation produced by purgatives never proves ſo debilitating as to render them improper: And as they have frequently an influence in relieving the head, they ſhould never be omitted, and ſhould always be preſcribed in ſuch doſes, and theſe as frequently repeated, as the ſtrength of the patient will permit;

but they ſhould never be carried ſo far as to run any riſk of inducing debility and languor.

In the following ſections, I ſhall have occaſion to enter on a more particular conſideration of the ſymptoms induced by inflammation of the membranes of the brain, and by concuſſion of the brain itſelf; but theſe general remarks upon the ſubject, appeared to be neceſſary here, with a view to explain the nature of our practice in the treatment of thoſe ſymptoms which proceed from either of theſe cauſes, when connected with a compreſſed ſtate of the brain, and when, accordingly, the operation of the trepan is not found to afford ſuch complete relief as it otherwiſe would do. Poſtponing, therefore, a particular detail of the remedies to be uſed in caſes of inflammation and concuſſion of the brain, I ſhall now ſhortly remark, that whenever the operation of the trepan fails in relieving the ſymptoms for which it is employed, as this gives reaſon to believe that they proceed from one or other of theſe cauſes, we ought in the moſt particular manner to diſcriminate between them. When inflammation is found to have taken place, blood-letting, both general and local, becomes requiſite, together with ſmart purgatives, mild ſudorifics, and a ſtrict attention to an antiphlogiſtic regimen: But when the ſymptoms appear to ariſe from concuſſion, the only evacuation that can with propriety be adviſed is gentle purging; for in this caſe, as I have already remarked, and as I ſhall afterwards endeavour more particularly to ſhew, blood-letting, inſtead of proving uſeful, very conſtantly does harm.

In both ſituations, as well as in every other requiring the trepan, the patient ſhould be kept perfectly quiet,—little or no light ſhould be admitted to his apartment,—any food he is able to take ſhould be of the mildeſt kind, and plenty of whey or any other diluent drink ſhould be allowed.

In the mean time, the ſtate of the wound requires particular attention; for after the operation of the trepan, the membranes of the brain are not only liable to inflame, but to become gangrenous. In wounds of other parts of the body, we know that nothing ſo certainly prevents inflammation and gangrene, as a free ſuppuration being induced upon the injured parts; and whoever will proſecute this practice in wounds of the head, will find, that although, from the nature of the parts that have ſuffered, it may not prove equally uſeful, that it will, however, anſwer better than any other that has as yet been employed.

With this view, warm emollient poultices and fomentations ſhould be applied over the dreſſings, and renewed every two or three hours; which ſoon tends to promote a plentiful flow of matter from the perforations in the ſkull, by which the tenſion is ſoon removed, at the ſame time that the other ſymptoms are rendered leſs violent.

At every dreſſing, the matter reſting in the perforations ſhould be removed with a piece of ſoft ſponge or lint, and thereafter the ſore ſhould be ſpeedily covered with a pledget of any mild ointment.

When the cure goes properly on, granulations ſoon appear upon the dura mater as well as on the reſt of the wound; and theſe continuing to advance, the different openings made by the trepan are at laſt completely filled up, and the whole being brought to a level with the reſt of the teguments, a cicatrix is thereafter obtained by the ſame means that prove ſucceſsful in other parts of the body, and of which I have already given a detail *.

Theſe granulations, however, which in general ariſe from the dura mater only, and not from the brain itſelf, as has commonly been ſuppoſed, inſtead of merely filling up the openings in the bone, in ſome caſes puſh out beyond the ſurface of the teguments, ſo as to form diſtinct pendulous tumors.

Theſe tumors or excreſcences, when they become large, prove ſometimes troubleſome, and various means have been propoſed

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* *Vide* Chapter IV.

propoſed for their removal. Being commonly conſidered as productions of the brain itſelf, much caution has prevailed in remedies that have been employed for them. Compreſſion is moſt frequently adviſed. In ſome inſtances they are kept down with eſcharotics, and in others with ſtrong cauſtic. Some have propoſed to remove them with ligatures, and others by exciſion.

Of all theſe modes of treatment, that by compreſſion is moſt to be dreaded, and ought certainly to be exploded: For whether the tumors ariſe from the brain or dura mater, preſſure cannot be applied to them without affecting the brain; and we commonly find, that even the ſlighteſt degree of it induces headach, ſickneſs, and in ſome inſtances convulſions. It ought not therefore in any caſe to be adviſed.

Theſe tumors are of various degrees of ſenſibility. In ſome, they are painful, and cannot bear to be touched; whilſt in others they are almoſt deſtitute of ſenſibility. In this laſt caſe, the moſt effectual treatment is to touch them daily with lunar cauſtic, or calcined alum, and when the tumor hangs by a ſmall neck, it may with ſafety be removed with a ligature.

We ſeldom, however, find it neceſſary to employ any of theſe means; for in general the tumors begin to diminiſh as ſoon as the ſoft granulations in the perforations of the ſkull begin to acquire a firmer conſiſtence; and by the time the oſſifying proceſs of this ſubſtance is completed, they commonly drop off ſolely by the preſſure which this never fails to produce. We ſhould not, therefore, in any caſe, proceed quickly to remove them; but when they do not fall off on the different perforations being filled with bone, as the connection between them and the brain is then in a great meaſure cut off, they may accordingly be removed with more ſafety, either by exciſion, cauſtic, or ligatures.

The cure being thus far complete, if the method that I adviſed was adopted, of ſaving all the ſkin and other teguments, a narrow cicatrix only will remain, and the parts will be nearly as firm as they were before: But when much of the ſkin and muſcles have been deſtroyed, as theſe parts are never renewed, the bone will be left covered by a thin cuticle only, with perhaps a very ſmall proportion of intermediate cellular ſubſtance; in which caſe a piece of tin or lead, lined with flannel, ſhould be fitted to the part, with a view to protect it from the effects of cold and external injuries.

When the ſymptoms ariſing from injuries done to the head, proceed entirely from a depreſſed portion of bone acting as a cauſe of compreſſion upon the brain; if this can be removed, a due perſeverance in the plan of management that I have propoſed, will in general anſwer. I muſt, however, allow, that they do not end in this favourable way ſo frequently as we could wiſh: For, along with the depreſſion of the ſkull, we often meet with ſymptoms, as I have obſerved above, either ariſing from concuſſion, inflammation, or gangrene; circumſtances at all times attended with uncertainty, and commonly with much hazard.

We now proceed to conſider the other general cauſe of compreſſion of the brain, namely, extravaſation.

§ 2. *Of Compreſſion of the Brain from Extravaſation.*

By whatever cauſe the brain may be compreſſed, the ſymptoms that enſue are nearly the ſame; and as theſe have already been minutely conſidered, it will not be neceſſary to enumerate them again. I ſhall only obſerve, that all the ſymptoms ariſing from a compreſſed ſtate of the brain, are induced with equal certainty, and attended with as much hazard, from effuſions of blood, ſerum, or pus, as from the moſt extenſive depreſſions of bone. Thoſe ſymptoms indeed that occur from extravaſation are more to be dreaded than depreſſions of great extent; for when a depreſſed portion of bone is large, the ſeat of the injury is for the moſt part eaſily known, and by proper means may often be removed; but where extravaſation takes place, our means of aſcertaining the ſeat of the injury are more uncertain, ſo that the effects of our remedies are leſs to be truſted. When indeed the brain is compreſſed by a complication of theſe two cauſes, a depreſſed portion of bone, and extravaſation of blood or ſerum, the ſeat of the one is readily diſcovered by that of the other; but when compreſſion is formed by extravaſation alone, it is always difficult, and often impoſſible, to diſcover the ſeat of it.

A complication of theſe two cauſes is by no means uncommon; for extravaſation of blood or ſerum is a frequent effect of fractures or depreſſion; but we likewiſe meet with inſtances of both being effuſed on the ſurface of the brain, without any injury being done to the bone.

In compreſſion of the brain from extravaſation, we have the ſame object in view, with that which a depreſſed portion of the ſkull renders neceſſary: Having endeavoured to aſcertain the ſeat of the injury, we are to make one or more perforations, in order to diſcharge the extravaſated fluid, and this being done, we are to guard againſt any effects which the operation might produce upon the brain and its membranes.

It ſometimes happens, that the part in which the collection is ſeated, is pointed out by the mark of a blow or bruiſe; and on the bone being laid bare, a fiſſure will in ſome inſtances be found in it, while in others no other injury is diſcovered, farther than a ſeparation of the pericranium from the ſurface of the bone.

When any of theſe circumſtances however take place, we ſhould conſider the ſeat of the injury to be ſo far aſcertained as to have no heſitation in fixing upon this ſpot for applying the trepan; but, in ſome caſes, no external mark of injury is diſcovered: even after the whole head is ſhaved, and minutely examined, the ſkin will in various inſtances be found perfectly ſound, without any appearance either of tumor or diſcoloration.

Hitherto it has been held as an eſtabliſhed maxim, never to apply the trepan in compreſſion of the brain from external violence where there is no external mark to point out the ſeat of the injury, the reſult of the operation being in ſuch caſes always uncertain: But as compreſſion of the brain, if not removed, muſt ſoon terminate in death, and as it cannot be removed in any other way than by perforating the ſkull, in ſuch circumſtances, to leave any thing undone which would give even the ſmalleſt chance of ſaving the patient, ſhews a degree of indifference not in any other inſtance met with in the ſurgery of modern times. It is with truth indeed ſaid, when no external injury takes place, that there is always much uncertainty of any perforation we can make being to fall upon the ſpot where the cauſe of compreſſion takes place; that as the ſymptoms induced by concuſſion, are often highly ſimilar to thoſe ariſing from compreſſion, much dubiety muſt occur from our not being able to ſay with preciſion, whether the ſymptoms depend upon one cauſe or the other; and it muſt be confeſſed, even where the ſymptoms have previouſly been ſuppoſed to ariſe from compreſſion, that in many inſtances no veſtige has appeared on diſſection, either of depreſſion of the ſkull, or of effuſion of blood or ſerum.

All this I ſhall admit; but to what does it amount? Why, to no more than this: That where a patient is evidently in much danger, and is to die if means are not employed for his relief, wherever there is much uncertainty in the effects of theſe means, that it will be better not to adviſe them, but rather to leave the patient to his fate! As long as the ſtate of a perſon in this ſituation affords cauſe to hope that he may recover by other means, it would no doubt be improper to employ the trepan; or if much additional riſk was to be incurred by the operation, no practitioner of character would adviſe it with ſo little probability of any advantage being to ariſe from it.

But as a patient labouring under the ſymptoms I have deſcribed, cannot be relieved by any other means, and in ſuch deſperate circumſtances as no additional hazard can be incurred from an operation, we ought certainly, in juſtice to the patient, to his friends, and to our own reputation, to adviſe it. The chance reſulting from it, will not indeed be great; but being the only means from whence ſafety can reſult, by employing it lives may be ſaved which otherwiſe would be loſt; and if a prognoſis ſufficiently guarded is given, no juſt blame could fall either upon the operator, or on the art. If the friends of the patient ſhould be told of the hazard he is in; that he may, however, have ſome ſmall chance of recovering, if the trepan is applied; even under this doubtful prognoſis, they would in a great proportion of caſes wiſh to have it done; and however unſucceſsful it might prove, and although no extravaſation, or other cauſe of a compreſſed brain, ſhould be met with, a prognoſis of this kind would in every inſtance ſcreen the operator from blame: and having thus done all that could afford any chance of his recovering, the friends of the patient, as well as the ſurgeon himſelf, would ſurely have more cauſe to be ſatisfied than if no attempt had been made for preſerving him.

I ſhall therefore ſuppoſe that the trepan is to be applied for the removal of ſymptoms ariſing from a compreſſed ſtate of the brain; but where no external mark indicates the particular ſeat of the injury, it may be aſked in what manner are we to proceed? As the cauſe of compreſſion may exiſt juſt as readily in one part as another, it may ſeem to be a matter of little importance in what part of the head the firſt perforation is made. This, however, is far from being the caſe: For, as we are ſuppoſing the compreſſion to be induced by blood or ſerum, and as theſe, while in a fluid ſtate, are always paſſing as much towards the baſis of the brain, as the intimate connection between the dura mater and the internal ſurface of the ſkull will permit; it will be proper to form the firſt perforation in the moſt inferior part of the cranium in which it can with any propriety be made, and to proceed to perforate every acceſſible part of the ſkull, till the cauſe of compreſſion is diſcovered. For this purpoſe there is no neceſſity, as I have already obſerved, to remove any part of the integuments: Wherever we mean to perforate the bone, if an inciſion is made through the ſkin, muſcles, and pericranium, they will retract ſufficiently for admitting the inſtrument; and this being all that is neceſſary, more ſhould not be done. If we are at laſt ſo fortunate as to meet either with blood or ſerum, much care ſhould be taken to diſcharge it; for which purpoſe, as blood, when coagulated, frequently adheres to the dura mater, inſtead of one perforation, two, three, or more ſhould be adviſed, ſo as to admit of all the extravaſated blood being removed.

But in ſuch circumſtances the operator ſhould likewiſe recollect that the blood, inſtead of being effuſed on the ſurface of the dura mater, may be collected within the cavity of that membrane; or it may even be contained within the pia mater, in immediate contact with the brain. For which reaſon the ſtate of the dura mater ſhould be examined with attention, after every perforation. If it is found to be of its natural colour, and not more tenſe than it ought to be, nothing farther ſhould be done; but if very tenſe and elaſtic, and eſpecially if it has that dark or livid appearance which indicates the probability of blood being collected beneath, it ought undoubtedly to be opened, in order to diſcharge it. The beſt and eaſieſt mode of doing this, is to ſcratch a ſmall hole by repeated ſtrokes with a lancet: This being done, and the point of a pair of curved ſciſſars being introduced beneath the dura mater, the opening may thus be enlarged to the full extent of the perforation in the bone; or if one cut acroſs the perforation is not ſufficient for diſcharging the blood beneath, a crucial inciſion may be made, and, if neceſſary, the corners thus produced may be cut off.

Although I would not recommend the diviſion of the dura mater, where not neceſſary for the ſafety of the patient; yet, in every inſtance where the operation of the trepan is adviſable, if, on perforating the bone, there is reaſon to ſuſpect that a fluid is collected either between this membrane and the pia mater, or even below the pia mater itſelf, as the intention of the operation would not otherwiſe be fulfilled, the collection, of whatever it may conſiſt, ought immediately to be diſcharged: In ſuch circumſtances, unleſs we go this length, we in fact do nothing: for the dura mater is ſo thick and ſtrong, that any blood or matter collected between it and the brain, would more readily ſpread inwards, than burſt out through the different layers of this membrane.

To this practice it has been objected, that few have recovered where it has been carried into effect; that there is a riſk of fatal hemorrhagies being induced by it; and that the brain is apt to protrude at the perforation in the bone, after it has loſt the ſupport of its ſurrounding membranes.

That few have recovered by this means, I will allow: But this does not proceed ſo much from the opening made in the dura mater, or from this part of the operation being particularly hazardous of itſelf; but, from the cauſe for which it is employed being productive of ſuch danger as puts it out of the power of art, either by this or any other means, to obviate the fatal effects of it.

With reſpect to hemorrhagies being apt to enſue from this practice; although I have ſeen the dura mater opened in ſeveral inſtances by others, and have different times done it myſelf, I never knew an inſtance of its doing harm, not even when any of the ſinuſes have by accident been laid open; and although the brain will no doubt protrude more readily when the dura mater is divided, than it otherwiſe might do, yet this we know is a frequent occurrence in every wound where much of the cranium is removed, and that conſiderable portions of the brain have been even diſcharged by wounds, without any material harm being done by it.

The reſult, therefore, of all that can be ſaid upon this point, is, that where the intention of the operation is fully anſwered by perforating the cranium; where any portion of bone that has been depreſſed is thus completely removed; or where any preſſure produced upon the brain is found to proceed from blood or ſerum on the ſurface of the dura mater; as in any of theſe caſes the cauſe of danger can be removed without penetrating this membrane, it ought not by any means to be done: But whenever the bad ſymptoms which have prevailed are not relieved by the perforation of the bone; or by the removal of any effuſed fluid that may be met with on the dura mater; and when from the appearance of this membrane there is cauſe to ſuſpect that a fluid is collected beneath; it ought undoubtedly to be opened. Even although the inconveniences reſulting from it were greater than they have ever been, when the life of a patient appears to depend on it, ſomething ought to be hazarded: But we have ſeen that the riſk attending this part of the operation is of little importance; ſo that I would conſider any practitioner as culpable who would adviſe it to be omitted, when a patient in theſe circumſtances has not been relieved by the previous ſteps of the operation.

In this ſituation our views ſhould be exactly ſuch as ought to direct us in the treatment of abſceſſes in other parts of the body. When a patient is ſuffering with matter collected in a particular part, no ſurgeon of experience will be deterred from going to the full depth of the collection merely from finding that it is more thickly covered than he had reaſon to expect before the ſkin and cellular ſubſtance were divided. He will proceed more ſlowly and with much caution; but he will at laſt reach the ſeat of the matter with as much certainty as if it had been more ſuperficially ſituated.

In like manner, when there is cauſe to imagine, that matter is collected beneath the membranes of the brain, an inciſion ſhould for certain be made through them. No additional riſk can be incurred from it: Some few may be ſaved by it; and at any rate, it muſt always afford ſatisfaction, not only to the friends of the patient, but to the practitioner himſelf, to know that nothing has been omitted from whence any advantage could be derived.

It will often indeed happen, that neither this, nor any other effort of art, will obviate the danger of the patient. But when the principles upon which an operation is founded are evidently juſt, and when, on mature deliberation, it appears, that a patient may be ſaved by it, and that he cannot eſcape by any other means, it is not the frequency of its ſucceſs alone by which we are to be directed: The danger induced by the cauſe for which it is employed is the object to be kept in view; and every practitioner who acts ſolely for the good of his patient, will at all times employ ſuch means as are beſt calculated for the removal of this danger, without paying attention to any other conſideration. If it were the object of ſurgeons to operate only where certain ſucceſs would enſue, many lives would be loſt that otherwiſe are ſaved; and in that caſe the practice I thus wiſh to inculcate, of applying the trepan in injuries done to the brain, where no external mark of direction exiſts, would no doubt be inadmiſſible: But as the ſafety of thoſe intruſted to us ought to be our firſt and great object, and profeſſional fame only a ſecondary conſideration, whenever we are certain that death muſt enſue, if not prevented by the timely application of a proper remedy, although there may be no great certainty of this remedy proving ſucceſsful, yet if it is the only means from whence there is a chance of ſafety, it ought undoubtedly to be employed. It is on this principle ſolely that I have adviſed the practice of perforating the ſkull in different places, when, in a compreſſed ſtate of the brain, the part chiefly affected is not pointed out by ſome external mark of injury: And although the opinion I have thus ventured to give is not agreeable to general practice, yet as this practice has ancient cuſtom only for its ſupport, being in every other reſpect apparently ill-founded, the advantages which may accrue from a different mode of treatment, will only require, as there is reaſon to hope, to be thus fully pointed out, in order to procure it a favourable reception.

Having fully adverted already to the after-treatment of caſes in which the trepan has been applied for the removal of a depreſſed portion of the ſkull, it will not be neceſſary to enter upon the ſubject again;

for whatever the cauſe may be for which the operation is practiſed, the cure of the remaining ſore ought to be conducted in the ſame manner.

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SECTION IV.

Of Concuſſion or Commotion of the Brain.

EVERY affection of the head attended with ſtupefaction, when it appears as the immediate conſequence of external violence, and when no mark of injury is diſcovered, is in general ſuppoſed to proceed from commotion or concuſſion of the brain; by which is meant ſuch a derangement of this organ as obſtructs its natural and uſual functions, without producing ſuch obvious effects on it, as to render it capable of having its real nature aſcertained by diſſection.

Almoſt all the ſymptoms commonly produced by a compreſſed ſtate of the brain, as enumerated in the laſt ſection, are in ſome inſtances met with from concuſſion: but thoſe which moſt frequently ariſe from it are, ſtupefaction; torpor to a greater or leſſer degree; a ſlow, ſoft pulſe; and a dilated ſtate of the pupils, even on the eyes being expoſed to light.

As it is not always eaſy, however, to determine from the ſymptoms, what particular affection of the head may have taken place, I ſhall endeavour to mark, as far as can be done, a diſtinction between concuſſion and inflammation, as well as between concuſſion and compreſſion, of the brain. It is an object of much importance, and therefore requires our moſt ſerious attention.

It is ſeldom difficult, as we have ſeen in the laſt ſection, to diſtinguiſh between the ſymptoms which proceed from inflammation, and thoſe that ariſe from concuſſion.—Such as proceed from concuſſion alone, commence immediately on the injury being done; in violent degrees of them, the patient remains totally inſenſible: the pupils are much dilated, and do not contract even when the eyes are expoſed to the ſtrongeſt light; and the pulſe, although ſometimes full, is not hard nor ſtrong, and it always becomes weaker on blood being taken away.

Thoſe ſymptoms again which originate from inflammation, ſeldom appear till ſeveral days after the accident: By the deſcription to be more particularly given of them in the following ſection, it will appear, that they are materially different from thoſe which proceed either from a compreſſed ſtate of the brain or from concuſſion. The pupils are not dilated; nay the eyes, excepting in the more advanced ſtages of the diſeaſe, are very ſenſible to the impreſſion of light; and the pulſe is firm and hard from the firſt, and does not become weaker on moderate evacuations of blood.

By theſe marks of diſtinction, as well as others, which an attentive practitioner will commonly notice, little uncertainty can prevail in determining whether ſymptoms proceed from concuſſion or inflammation; ſo that with reſpect to this point we may ſoon determine on the practice to be purſued. And again, we can eaſily diſtinguiſh between ſymptoms ariſing from ſlight degrees of concuſſion, and thoſe which proceed from compreſſion. Thus, when a perſon is knocked down by a blow upon the head, and quickly recovers from the more alarming effects of it, but remains for a conſiderable time giddy; with ſlight pains in different parts of his head; with tinnitus aurium, weakneſs of ſight; ſome degree of imbecillity, and loſs of memory; if no other ſymptoms occur, and eſpecially if he is able to walk about, as frequently happens even in high degrees of theſe ſymptoms; we conclude from experience in ſimilar caſes, that they all proceed from commotion or concuſſion, and not from compreſſion of the brain; for the ſymptoms which proceed from compreſſion are of a more permanent nature, and uniformly continue till the cauſe which produced them is removed.

But where the ſymptoms are important from the beginning, and eſpecially when the patient is altogether inſenſible, if no external mark of injury takes place, it is always difficult to determine whether they depend upon concuſſion or depreſſion. Indeed inſtances often occur, in which ſymptoms ſuppoſed to originate from concuſſion, have after death been found to proceed from extravaſation, or perhaps from a fracture attended with depreſſion of the ſkull which had not been previouſly diſcovered. And again, ſymptoms have often been ſuſpected to ariſe from extravaſation, when on diſſection, no veſtige either of this or any other morbid appearance could be traced.

So far as my obſervation goes, the moſt material difference between the ſymptoms ariſing from theſe two cauſes, concuſſion and compreſſion of the brain, is met with in the pulſe and breathing. In a compreſſed ſtate of the brain, the breathing is commonly deep and oppreſſed, ſimilar to what takes place in apoplexy; whereas, in patients labouring under the effects of concuſſion, the breathing is in general free and eaſy, and the patient lies as if he was in a ſound and natural ſleep. The pulſe is commonly ſoft and equal, and not irregular and ſlow, as it uſually is when the brain is compreſſed. In a compreſſed ſtate of the brain, although little or perhaps no relief may be obtained from blood-letting, yet no harm is obſerved to enſue from it; ſo that in moderate quantities, it does not reduce either the frequency or ſtrength of the pulſe: Whereas in concuſſion of the brain, the pulſe, as I have already remarked, will frequently ſink, and become much more feeble on the loſs of only eight or ten ounces of blood.

In doubtful caſes, therefore, a quantity of blood ſhould be immediately diſcharged: If the pulſe, upon ſix or eight ounces being taken away, is found to be ſtronger and fuller than before; if the blood is found to be ſizy; and eſpecially if the patient becomes more ſenſible; we may conclude with much probability, that the ſymptoms depend either upon extravaſation; upon ſome part of the ſkull being depreſſed; or upon ſome degree of inflammation: and as long as the pulſe remains firm, and any advantages are gained by it, we may with ſafety proceed to diſcharge more blood.

But when the pulſe, upon a few ounces of blood being taken, becomes feeble, eſpecially if the patient becomes weak and languid, as almoſt always is the caſe when the ſymptoms proceed from concuſſion, as the nature of the caſe is thus rendered in ſome meaſure certain, any farther diſcharge ſhould be immediately prevented.

I have already endeavoured to ſhow, that concuſſion of the brain appears to operate by inducing debility of the whole ſyſtem; our remedies, therefore, inſtead of tending to increaſe this, as blood-letting very certainly does, ſhould be ſuch as give additional vigour.

With this intention, in ſimilar circumſtances ariſing from other cauſes, we would adviſe not only the internal uſe of cordials, but the outward application of ſtimulants; and as ſymptoms of debility in the caſe we are now conſidering, are as ſtrongly marked as in any diſeaſe whatever, I am clearly of opinion, that cordials, and even ſtimulants, are equally neceſſary in the method of cure.

Many practitioners have acknowledged, that although they have by general cuſtom been induced to take blood freely in all injuries done to the head, that in various inſtances no benefit has been derived from it, and in ſome that it has even done harm. Having met with many inſtances of this, in which all evacuations of blood ſunk the ſtrength of the patient in an alarming manner; and finding indeed, unleſs where the ſymptoms aroſe clearly from inflammation, that few, if any, recovered, when the practice of diſcharging much blood was carried far, I was induced in the firſt place to ſee what would reſult from no evacuation of blood being adviſed, and truſted chiefly to laxatives, and a gentle moiſture being kept upon the ſkin. On finding that no bad effects enſued from it, and, even that more patients recovered than had commonly done from blood-letting, I was thereby induced to carry the practice farther.

Upon this principle, cordials were given internally: ſtimulants, particularly bliſters, were applied externally, in the ſame manner as is uſually done, in debility proceeding from any other cauſe; and hitherto the effects that reſult from it have been ſuch as ſufficiently warrant a continuance of the practice.

In every caſe, therefore, where concuſſion of the brain appears to be the cauſe of the ſymptoms, the practice I would recommend is, to exhibit in a gradual manner ſuch quantities of warm wine as would appear to be proper for the ſame ſymptoms of debility induced by any other cauſe: As patients in ſuch circumſtances are apt to become cold, they ſhould be kept warm by proper coverings: A bliſter ſhould be applied over all that part of the head of which the ſkin has not been injured; ſinapiſms ſhould be applied to the feet; and although ſtrong purgatives would be improper, by tending to reduce the ſtrength of the patient, yet gentle laxatives prove always uſeful, and ſhould be regularly given, when the ſtate of the bowels requires them.

As wine is a cordial upon which we can place more dependence than on any other with which we are acquainted, it ought in this, as in every caſe where cordials are required, to be preferred. But although with due pains, by opening the patient's mouth, and putting it in with a ſpoon, it may in almoſt every caſe be exhibited; yet occaſionally we meet with inſtances in which it cannot be ſwallowed in ſufficient quantity: In this caſe the volatile alkali, ardent ſpirits, and other cordials of a more active kind, ſhould be given.

In concuſſions of the brain, Mr Bromefield has recommended the uſe of opiates; a circumſtance which tends much to corroborate the opinion I have endeavoured to eſtabliſh of the nature of this affection; for few medicines act with more certainty as cordials than opium. When conjoined with antimonials, I have frequently found it prove uſeful; but although I have upon ſuch reſpectable authority employed opium by itſelf, I have not hitherto found it anſwer ſo well as wine. This, however, may proceed, either from my not having puſhed the uſe of it ſo far as I ought to have done; or, from the few caſes in which I have employed it having been ſuch as would not have done well whatever remedy might have been uſed. I muſt, therefore, have farther experience of its effects before venturing to ſpeak of it with more deciſion.

Iſſues are commonly adviſed here; but as more advantage I believe is to be derived from the ſtimulating powers of bliſters, than from any diſcharge which they produce, inſtead of preſerving a bliſtered part open, with iſſue-ointment, as is uſually done, I would prefer a repeated and frequent renewal of bliſters on different parts of the head and neck. In this manner, any advantage to be derived from them as drains, will be equally certain as from iſſues; and by applying one bliſter on another being nearly heal, almoſt a conſtant ſtimulus will be kept up.

In the progreſs of the cure, we ſometimes derive advantage from a liberal uſe of bark and ſteel mineral waters. Gentle emetics have likewiſe proved uſeful; and when much languor, inactivity, and loſs of memory, have continued more permanent than uſual, electricity has been employed with advantage.

It muſt however be remembered, that, in recommending this practice, it is expreſsly for the removal of ſymptoms that ariſe from concuſſion, and that do not depend either upon a compreſſed ſtate of the brain or on inflammation; a circumſtance which may in general be ſo far aſcertained as to render it obvious whether ſuch a courſe is proper or not, merely by the effects that are obſerved to reſult from blood-letting. Attentive obſervation of other circumſtances might in ſome inſtances enable us to decide upon this point, without the neceſſity of having recourſe to this means of diſtinction; but where there is ſuch room for uncertainty as frequently prevails here, and where the life of a patient is to depend on the practice to be purſued, nothing ought to be omitted that can tend to eſtabliſh an accurate knowledge of his ſituation. In ſuch circumſtances, therefore, there is no room to heſitate; ſo that where much doubt and uncertainty take place, as much blood ſhould be diſcharged as may tend to determine the nature of the caſe.

This is the practice I would always adviſe for the removal of ſymptoms ariſing ſolely from concuſſion: And accordingly, I have not thought it neceſſary to mention the uſe of the trepan; for although it is very univerſally adviſed, yet unleſs where ſymptoms take place of a compreſſed ſtate of the brain, no good reaſon can be aſſigned for it. But in caſes of doubt and uncertainty, and eſpecially where a patient remains comatoſe and inſenſible, the trepan ought by all means to be employed; for as in theſe circumſtances it could not add to the danger; and as it affords the only chance of ſafety in ſymptoms ariſing from compreſſion, practitioners would be highly blamable were they not to adviſe it; and as the hazard of the patient muſt here be imminent, perforations ſhould be made in every acceſſible part of the ſkull as long as the cauſe remains undiſcovered.

We now proceed to conſider more particularly the effects of inflammation upon the brain.

SECTION V.

Of Inflammation of the Membranes of the Brain from external Violence.

INFLAMMATION in every part of the body demands particular attention, more eſpecially in organs of importance; for its effects being in general violent and rapid, if not quickly removed they commonly end in more permanent diſtreſs:—If this is the caſe in parts of leſs importance, it is more particularly ſo in inflammation of the membranes of the brain.

Inflammation of the brain and of its membranes is apt to produce all the ſymptoms that commonly occur in inflammatory affections of other parts, while at the ſame time it excites a ſet of ſymptoms in ſome degree peculiar to itſelf. By whatever cauſe inflammation of the brain or of its membranes may be induced, the ſymptoms do not appear immediately; ſeldom indeed till ſeveral days after the injury, and often not till two, three, or more weeks, have elapſed; a circumſtance, I muſt again obſerve, that ſerves with more certainty than any other to diſtinguiſh inflammation of theſe parts from every other affection to which they are liable: For, while the ſymptoms of inflammation approach by ſlow degrees, the effects of concuſſion ſucceed inſtantly to the injury by which they are produced; and this is alſo the caſe with thoſe ſymptoms that proceed from a depreſſed portion of bone, or from extravaſation of blood or ſerum.

At ſome uncertain interval, of two or three days, in ſome caſes of as many weeks, and in a few inſtances of two or three months from the date of the injury, the patient begins to feel an univerſal uneaſineſs over his head, attended with liſtleſſneſs and ſome degree of pain in the part that was hurt, but of which perhaps he has not till now had any cauſe to complain.

The liſtleſneſs becomes more remarkable,—the patient appears dull and ſtupid,—and the pain becomes more ſevere in the injured part ; while in other parts of the head a ſenſation of fulneſs takes place as if the brain was girded or compreſſed: The patient complains of giddineſs, nauſea and retching. He finds himſelf hot and uneaſy ;—his ſleep is diſturbed,—and he is not refreſhed either with what he enjoys naturally, or by what is procured with opiates. The pulſe is firm, or rather hard and quick, as it almoſt always is indeed in inflammatory affections of membranous parts: The face is commonly fluſhed,—the eyes are from the beginning ſomewhat inflamed,—and expoſure to light creates a good deal of pain.

Where the ſymptoms are accompanied with a wound of any part of the head, this fluſhing of the face and inflammation of the eyes are apt to be attended with and ſeem to depend upon an eryſipelatous affection proceeding from the ſore: In which caſe the edges of the wound firſt become hard and tumefied; and the ſwelling, which appears to originate in the aponeurotic expanſion of the muſcles of the head, ſpreads quickly over the whole of it, eſpecially towards the eyelids; which often become ſwelled to ſuch a degree as to ſhut the eyes entirely. This ſwelling is ſomewhat ſoft, and receives with eaſe any preſſure that is made on it:—It is painful to the touch,—and the ſkin over the whole of it has an eryſipelatous degree of redneſs.

This diffuſed ſwelling, however, although formidable in appearance to thoſe who are not verſant in this branch of practice, does not in general prove ſo dangerous, as that puffy circumſcribed tumor to which the parts that received the blow are more eſpecially liable; for this eryſipelatous ſwelling, which extends over almoſt the whole head, proceeds moſt frequently not from any thing bad within the ſkull, but merely from the external wound in the tendons or muſcles: In which caſe all the ſymptoms that take place, very commonly vaniſh by the effect of thoſe means which uſually anſwer beſt in eryſipelas in other parts. In a few inſtances, however, this ſymptom appears to ariſe from an affection of the dura mater; in which caſe its tendency is always of the moſt dangerous nature, and therefore requires our moſt ſerious attention.

Soon after theſe ſymptoms have taken place, the part which received the blow begins to aſſume ſome appearances of diſeaſe. If the bone has been laid bare, it is now obſerved to loſe its natural healthy complexion: It becomes pale, white, and dry, either over its whole ſurface, or in particular ſpots which by degrees extend over the whole; and the edges of the ſore, from the firſt commencement of the ſymptoms, become hard, dry, ſwelled, and painful: But when the bone has not been denuded, and when none of the ſofter parts have been divided, but merely contuſed, they now begin to ſwell, become puffy, ſomewhat painful to the touch, and if the head is ſhaved, the ſkin is obſerved to be of a more deep red than in the reſt of the head: If, in theſe circumſtances, the ſwelled part is now laid open, the pericranium will in all probability be found detached from the ſkull; a ſmall quantity of a thin, bloody, and ſomewhat fetid ichor will be found between this membrane and the bone; and the bone itſelf will be diſcoloured in nearly the ſame manner as if it had been laid bare from the beginning.

With proper aſſiſtance, all theſe ſymptoms are for the moſt part ſoon carried off; but when either neglected from the beginning, or when not quickly removed, they very conſtantly become worſe. The pulſe ſtill continues quick and hard; the patient becomes more and more reſtleſs; and in ſome inſtances, delirium takes place. His ſkin is in general hot, but at times he is ſeized with ſhiverings, which gradually become not only more ſevere, but more frequent, and at laſt they are commonly ſucceeded by coma or ſtupor.

About this period all theſe ſymptoms either become ſo much milder as not to be diſtinctly obſerved, or they are altogether loſt in thoſe that enſue.—Paralyſis of one ſide is not unfrequent; the pupils become dilated, and are ſcarcely affected by the impreſſion of light; the urine and fæces are paſſed involuntarily; ſubſultus tendinum and other convulſive ſymptoms take place; and, if the patient is not ſpeedily relieved, death very quickly enſues.

Theſe are the moſt frequent ſymptoms ariſing from inflammation of the membranes of the brain. Others are met with in particular inſtances; but thoſe that I have narrated are the moſt frequent, and they ſerve to mark the preſence of the diſeaſe with ſufficient preciſion.

In this enumeration, attentive obſervation will readily diſtinguiſh two ſets of ſymptoms; each of which is connected with and clearly points out a particular ſtate or ſtage of the diſeaſe. The one I would name the Inflammatory ſtate, and the other the Suppurative or Purulent ſtate.

In the treatment of theſe ſymptoms, it is of much importance to attend to this diſtinction. It ought to ſerve indeed as the baſis of our practice, in ſo far as the remedies to be uſed in the one ſtage of them are improper or even inadmiſſible in the other.

During the prevalence of inflammation, we rely chiefly on the effects of blood-letting; but we ought to abſtain from it, when the diſeaſe has advanced to ſuppuration. In this ſtate the operation of the trepan can alone give relief; while during the continuance of inflammation, it is not only uſeleſs, but might even do harm. I ſhall hereafter, however, have occaſion to ſpeak more particularly of this.

External violence may induce inflammation of the brain and its membranes in three different ways; by depreſſed portions of the ſkull irritating the dura mater; by contuſion; and by ſimple fiſſures or fractures of the ſkull not attended with depreſſion. The firſt of theſe we have already conſidered, and I ſhall now proceed to treat ſeparately of the other two.

§ 1. *Of Contuſion of the Head.*

It is not thoſe ſlight contuſions which affect the teguments of the head only that we are now to conſider: It is ſuch only as in their conſequences prove formidable by communicating inflammation to the membranes of the brain that it is here neceſſary to mention.

A contuſion of the head may be produced in the ſame manner with contuſions of other parts; by falls, blows, and by ſtones or other miſſile weapons thrown from a diſtance. It may be attended with wounds of the ſkin and other teguments; or the ſkin, as moſt frequently happens, may be left entire.

The moſt frequent effect of thoſe blows upon the head that afterwards end in danger, is inſtantly to deprive the perſon of his ſenſes, who complains, on his beginning to recover from this, of ſome degree of giddineſs, which continues for a longer or ſhorter period, according to the degree of violence which the brain has ſuffered. In a gradual manner, however, the patient recovers ſo as commonly to be nearly well after a night's ſleep; and unleſs a wound has been produced along with the contuſion, he ſeldom or never complains of the part on which the injury fell, till ſeveral days after the accident.

The time that intervenes between a blow being given and the commencement of the after-ſymptoms is very uncertain: Theſe ſymptoms all originate from inflammation, and this again makes a ſlow or rapid progreſs according to the violence of the cauſe, and habit of body of the patient. Hence, in ſome caſes, the inflammatory ſymptoms appear in the courſe of a day or two; whilſt, in others, the patient continues perfectly well for ſeveral weeks, and at laſt is ſeized with pain and inflammation of the part that was firſt hurt, and from which alone all the train of bad ſymptoms proceed that I have mentioned: Nay, inſtances have occurred of caſes of this kind ending fatally, in which no appearance of any thing morbid was obſerved on the part that received the blow, till the eightieth, ninetieth, or even till the hundredth day from the accident.

Hence, it is evident, that much danger may ariſe from injuries done to the head, which do not at firſt exhibit any ſuſpicious appearance: A circumſtance that points out the propriety of paying the moſt accurate attention to every violence which it receives.

In the treatment of contuſions of the head, the indications to be kept in view are,

1. To employ the moſt effectual means for preventing inflammation.

2. When theſe do not ſucceed, we ſhould endeavour to keep the ſymptoms moderate, and to prevent the formation of matter.

3. When this proves to be impracticable, and when ſuppuration takes place, a free vent ſhould be procured for the matter: And,

4. When the injured parts are attacked with gangrene, the moſt effectual means ſhould be immediately employed for putting a ſtop to it.

With reſpect to the firſt indication, I may remark, that in ſlight contuſions of the head we ſeldom have it in our power to employ any prophylactic or preventative means. Patients commonly recover ſpeedily from the immediate effects of contuſions, and, till the after-ſymptoms commence, they ſeldom complain of any thing but a ſlight ſoreneſs in the injured ſpot. Practitioners are not often informed therefore of the accident till it is too late; and when they are, the patient will ſeldom ſubmit to any courſe that might prove uſeful. But when this can be done, the means we ſhould adviſe are, blood-letting, both general and local, to a conſiderable extent;—the uſe of laxatives, to preſerve an open ſtate of the bowels ;—the application of a ſtrong ſolution of ceruſſæ acetata to the part affected ;—a low diet, and total abſtinence from every kind of fatigue.

Saturnine and other cold applications are ſometimes employed with advantage even where the brain and its membranes appear to be hurt, but they prove chiefly uſeful, where the injury is confined to the external parts of the head.

By theſe remedies, the effects of many injuries done to the head might be prevented: But practitioners, as I have remarked above, are ſeldom called till the bad ſymptoms have commenced; the particular treatment of which we are now to conſider.

In every inſtance, we ſhould endeavour, as quickly as poſſible, to carry off the inflammation; the moſt effectual remedies for which are, blood-letting, purgatives, mild ſudorifics, and opiates, along with local applications to the injured part.

In common practice, the blood is, in ſuch circumſtances, taken indiſcriminately from any part of the body: But by many of our older writers, and even by ſome of the moderns, we are told, that blood taken from the feet proves more effectual than the ſame quantity taken from any other part.

This, however, is an idea built upon the erroneous doctrine of derivation and revulſion, which is now very generally exploded. Inſtead of which, we find, that in every caſe of inflammation, any blood that we diſcharge proves moſt uſeful when taken from the injured ſpot. We particularly obſerve, in injuries done to the head, that much advantage enſues from the blood that is diſcharged from veſſels divided in the operation of ſcalping, or that of laying the ſkull bare; a circumſtance which ſtrongly indicates the propriety of local blood-letting in all affections of this kind.

On this principle, when a ſufficient quantity of blood can be got by the application of leeches, or by cupping and ſcarifying near to the injured part, this mode of diſcharging it ſhould be preferred: But when this cannot be done, we may always ſucceed by ſcarifying the parts with a lancet or ſcalpel; a practice from which I have in different inſtances derived much advantage, and which I therefore wiſh, in the ſtrongeſt manner, to recommend. When the ſkull is already laid bare by the injury, or when the ſcalp has been divided in order to diſcharge any matter collected beneath, there can be no neceſſity for theſe ſcarifications; but when the teguments remain entire, or are only ſlightly hurt, and are attacked in a particular part with inflammation, ſcarcely any remedy anſwers ſo well as ſcarifications, which, in order to prove uſeful, ought to be freely carried into the parts beneath, with a view to divide the largeſt arteries that can be reached. In this manner, any neceſſary quantity of blood may be taken, and it proves always more certainly uſeful than any other mode of diſcharging it.

When this operation however is not agreed to by the patient, or when general blood-letting may be judged more adviſable, it anſwers beſt to open the jugular vein or temporal artery. With reſpect to the quantity of blood to be diſcharged, this muſt always depend on the violence of the ſymptoms and ſtrength of the patient: but in circumſtances ſuch as we are conſidering, as the patient's recovery or death is probably to depend on what is done in a very ſhort ſpace of time, blood-letting, as being the remedy on which our hopes ought chiefly to be founded, ſhould be puſhed immediately to as great a length as with ſafety can be done. Inſtead of taking eight or ten ounces, and repeating the operation, as is uſually done, I always think it right, as I have juſt obſerved, to be determined by the ſtrength of the patient, and to draw blood as long as the pulſe continues firm. While this continues to be the caſe, no danger occurs from the evacuation; and in all caſes of violent inflammation, it anſwers the purpoſe with moſt certainty, to take twenty or twenty-five ounces of blood at once, than to abſtract even a larger quantity by repeated operations. In the courſe of a few hours, again, if the ſymptoms ſtill continue ſevere, and if the pulſe remains ſufficiently full, it may be proper to diſcharge an additional quantity; but this likewiſe ſhould be determined by the effects that reſult from it.

Together with a plentiful evacuation of blood, the bowels ſhould be freely emptied, by briſk purgatives when theſe can be exhibited; or when they cannot be taken in ſufficient quantities, ſtimulating glyſters ſhould be given inſtead of them. In all affections of the head, it is an object of importance to preſerve an open ſtate of the bowels, particularly where inflammation has attacked the brain: It is not, however, an open ſtate of the bowels merely that proves uſeful. In order to receive much benefit from the practice, a ſmart purging ſhould be kept up, with repeated doſes of calomel, jalap, ſenna, or ſome of the neutral ſalts.

As it is found in every caſe of inflammation, that advantage is derived from the ſkin being kept ſoft, it ought always to be adviſed in an inflamed ſtate of the brain. Perſpiration may, for the moſt part, be induced by warm fomentations applied to the feet and legs, and laying the patient in blankets inſtead of linen; but when means of this more ſimple kind do not anſwer the purpoſe, more powerful ſudorifics muſt be employed.

In a great proportion of caſes, the common effervefcing draughts anſwer ſufficiently well, particularly when a few drops of antimonial wine are added to each doſe: The calx antimonii nitrata, which appears to be the ſame with Dr James's celebrated powders, is ſometimes uſed with advantage; but nothing acts with ſuch certainty as a combination of opium and antimony, or opium and ipecacuanha, as we have it in the form of Dovar's powder.

This laſt is recommended by a late celebrated practitioner of London, Mr Bromfield *; and I know from frequent experience, that the other proves often highly beneficial, and that it acts with entire ſafety.

In ſevere degrees of pain, large doſes of opium become neceſſary. A general prejudice has till of late indeed prevailed againſt the uſe of opiates in all caſes of inflammation, particularly in inflammation of the brain; but this ſeems to have ariſen more from an erroneous idea of the proximate cauſe of inflammation, and of the modus operandi of opiates, than from actual obſervation of the effects which they produce. By exciting ſome degree of heat, and in ſome inſtances increaſing the fulneſs of pulſe, it has been ſuppoſed that they muſt always do harm in inflammation; but I can from much experience of their effects aſſert, that theſe fears are groundleſs; and even in inflammation of the

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* *Vide* Chirurgical Obſervations and Caſes by William Bromfield, p. 12. vol. i.

the brain, that very important advantages often reſult from them. By leſſening the pain, and removing that reſtleſs ſtate of anxiety that commonly prevails, they frequently prove more uſeful than any other remedy.

Theſe are the means on which we chiefly rely; but ſome attention is likewiſe neceſſary to the local treatment of the injured parts, from which more advantage I think may be derived than is commonly imagined.

Inſtances often occur of inflammation in other parts of the body being relieved by drains or iſſues; and on the ſame principle I have long been in the habit of adviſing drains in inflammatory affections of the head.

With a view to this, when the teguments are divided, whatever the extent of the cut may be, as the lips of the ſore are apt to become hard, dry, and painful, thoſe applications ſhould be adviſed which anſwer beſt in promoting the formation of matter: The ſore ſhould be covered with pledgets of lint ſpread with any emollient ointment, and warm emollient poultices ſhould be laid over the whole. In this manner, and particularly by a frequent renewal of poultices, a plentiful diſcharge of matter is commonly induced; which ſoon leſſens the pain, and removes the hardneſs of the injured parts, by which all the other ſymptoms ſoon become moderate.

Where again the teguments are not divided, as ſoon as there is cauſe to ſuſpect, from the parts that were injured becoming pained and ſwelled at the diſtance of ſeveral days perhaps from the accident, that bad ſymptoms may ſupervene, the tumor ſhould be immediately laid open, by dividing the ſkin and teguments down to the pericranium; and if that membrane is found to be ſeparated and raiſed from the bone, it ought alſo to be laid open: By this means any matter that is confined, and which otherwiſe might have done harm, will be diſcharged; and by inducing a ſuppuration upon the ſore, in the manner I have mentioned, all the ſymptoms will be kept moderate.

In the treatment of theſe tumors, they are ſeldom opened till a fluctuation is diſtinctly perceived in them. In this, however, I think we are wrong; for the matter that tumors of this kind contains is conſtantly thin and acrid; ſo that to confine it in contact with the ſkull, muſt not only render the bone liable to become carious, but muſt even incur ſome hazard of making the inflammation ſpread to the membranes of the brain: for, as an intimate connection takes place between the veſſels of the pericranium and dura mater; and as it is evident in this kind of injury, where the external parts are firſt hurt, that the dura mater becomes inflamed only in conſequence of its connection with theſe, I have long thought it probable, that the confinement of acrid matter beneath the pericranium, is to be conſidered as the moſt frequent cauſe of the inflammation being communicated to the parts within the ſkull: I have accordingly been in the habit of diſcharging it by a free inciſion, as ſoon as the leaſt tumefaction on the part affected is perceived; and evidently with much advantage.

In all injuries indeed done to the head, in which the ſymptoms do not commence till ſeveral days after the accident, as the inflammation does not originally attack either the brain or its membranes, for if it did ſo, its effects would be immediate, it is probable that it acts almoſt ſolely by producing an effuſion between the pericranium and ſkull: And as we know that membranous parts ſeldom or never afford good pus, any effuſion which takes place muſt commonly be of a nature that will not readily become purulent, and will therefore be apt to acquire that kind of acrimony commonly met with in every extravaſated fluid that cannot be converted into pus.

Where the effuſion is conſiderable, an evident tumefaction takes place from the beginning: But it often happens, that it is ſo ſmall in quantity as ſcarcely to produce any perceptible ſwelling at firſt; in which caſe, as there is little or no tenſion, the patient feels little uneaſineſs till the effuſed fluid begins to turn acrid, which may happen ſooner or later according to the violence of the injury, and habit of body of the patient, as well as other circumſtances. But as ſoon as it becomes acrid, it excites pain, inflammation, and ſwelling; and as the pericranium and aponeurotic expanſions of the muſcles are very firm and ſtrong, if this acrid matter be not ſoon diſcharged by an inciſion, it gradually inſinuates between thoſe parts of the pericranium and bone beneath that were not at firſt affected: And as this extends the effects of the injury, it not only tends to increaſe the tumor of the integuments, but, by means of the vaſcular connection that I have mentioned between the pericranium and dura mater, the inflammation is at laſt conveyed to the parts within the ſkull; and as ſoon as theſe inflame, but never till then, the bad ſymptoms are ſure to take place.

It is therefore probable that the confinement of this acrid matter beneath the pericranium, muſt have no ſmall effect in promoting the progreſs of the inflammation; and hence, to diſcharge it by an inciſion is always adviſable whenever there is cauſe to ſuſpect, from the acceſſion of pain and ſome degree of tumefaction as the conſequences of external violence, that matter is collected even in the ſmalleſt quantity between this membrane and the ſkull.

It muſt be remarked, however, that I do not wiſh to recommend this practice in the treatment of tumors recently produced by external violence. It often happens, that a tumor of a conſiderable ſize ſucceeds inſtantly to a blow on any part of the head; but in general this ſoon diſappears on the application of mild aſtringents, ſuch as ſolutions of crude ſal ammoniac, white vitriol, or ſaccharum ſaturni: Ardent ſpirits make alſo a good application for theſe tumors, and they ſeldom fail to remove them.

It would therefore be improper in all ſuch caſes to lay the injured parts open; a practice, however, often adopted by thoſe who are not verſant in this branch of buſineſs; for, as this kind of tumor frequently affords, to manual examination, a ſenſation ſimilar to what is experienced from a depreſſion of the ſkull, young practitioners are very apt to be deceived with it, and to adviſe the ſkull to be immediately laid bare. But no practitioner of experience will ever be deceived with theſe appearances; nor will he ever proceed to lay the ſkull bare, if more evident marks do not take place of its being injured, or of matter being extravaſated beneath the ſkull itſelf. But whenever a tumor attended with pain, appears at a diſtant period upon the ſpot on which a blow or a bruiſe was received, as it ſeldom or never happens that ſwellings of this kind are of a harmleſs nature, or that they can be diſcuſſed by external applications, they ſhould in every inſtance be laid open as ſoon as they become perceptible. By doing ſo, we can never do harm; while we always derive advantage from diſcharging acrid matter, which in circumſtances ſuch as we are conſidering, is almoſt always collected beneath the pericranium.

An inciſion made for diſcharging matter, muſt neceſſarily go to the depth at which the matter is ſeated; otherwiſe the purpoſe for which it is meant will not be anſwered: And as in the circumſtances now under conſideration, it is almoſt in every inſtance collected beneath the pericranium, this membrane ſhould always be freely divided. But in making ſcarifications in the manner I have adviſed above, for the purpoſe of diſcharging blood, as they are ſuppoſed to be neceſſary before any tumor has appeared, and not intended for the evacuation of matter, they need never be carried to ſuch a depth. They ſhould paſs indeed freely into the cellular membrane, otherwiſe the arteries of the part will not be ſufficiently divided; but as no advantage could be derived in this ſtate of the diſeaſe from dividing the pericranium, and as the bone might be hurt by it, it ought never to be adviſed.

The wound produced by the inciſion, ſhould be dreſſed with any emollient ointment; and by the frequent renewal of warm poultices over the whole, a plentiful ſuppuration will be induced, which, as I have already remarked, proves commonly very effectual, not only for preventing, but removing all thoſe bad ſymptoms which inflammation of theſe parts is ſure to induce.

When, however, the inflammatory ſtate of the brain does not yield to this treatment; when the ſymptoms become more violent, and are ſucceeded by paralyſis, irregular convulſive motions, involuntary paſſage of the fæces and urine, dilatation of the pupils, and inſenſibility to the impreſſion of light, along with a ſlow and full pulſe; and more eſpecially when theſe ſymptoms have been preceded by fits of rigor or ſhivering; we conclude, that the ſuppurative ſtate of the diſeaſe has taken place; that matter is formed within the ſkull, and operates by compreſſing the brain.—Shivering fits take place on the formation of large abſceſſes wherever they are ſeated; but in inflammatory affections of the brain, they prove ſo certainly characteriſtic of ſuppuration, that no doubt can remain of matter having formed, whenever they are found to accompany the other ſymptoms that I have mentioned.

The exiſtence of matter within the cranium being aſcertained, as we cannot depend on any other means for carrying it off, the trepan ſhould be immediately adviſed; and as the ſafety of the patient is to reſt entirely on a free diſcharge being given to the matter, it ſhould be applied with much freedom. In ſuch circumſtances, indeed, it would be very culpable timidity in any practitioner to heſitate in forming as many perforations as are neceſſary for diſcharging the matter.

When, on perforating the ſkull, no matter is met with, if the dura mater appears to be more tenſe than uſual, as this will give cauſe to ſuſpect that the ſymptoms of ſuppuration have ariſen from matter collected between this membrane and the pia mater, or perhaps upon the brain itſelf, we ought not to reſt ſatisfied with having merely perforated the bone: If in ſuch circumſtances we proceed no further, the matter will ſtill remain confined; the brain will be nearly as much compreſſed as before; and of courſe no advantage will be derived from the operation.

In this ſituation, therefore, a practitioner ſhould not heſitate in dividing the membranes of the brain. But, for the method of effecting this, as well as for ſome further obſervations which relate to it, I muſt refer to the ſecond ſection of this chapter, where the ſubject has been fully conſidered.

When, again, it is found on perforating the ſkull, that the dura mater has become ſloughy, with ſome tendency to gangrene, the utmoſt danger is to be dreaded: If mortification has commenced, death will ſoon probably terminate the ſcene, although inſtances have occaſionally occurred of ſloughs forming upon the dura mater, and of cures being accompliſhed after theſe have ſeparated: All, however, that art ſhould in ſuch caſes attempt, is to preſerve the ſores clean; to ſee that any matter which may form ſhall be freely diſcharged; to take care that nothing but light eaſy dreſſings ſhall be employed; and that Peruvian bark, conjoined with elixir of vitriol, ſhall be immediately given in as great quantities as the ſtomach will bear. If any tendency to inflammation ſtill prevails, the diet ſhould be low, with a plentiful allowance of whey and other diluents, and regular ſtools ſhould be procured: But, when the ſyſtem is low and the pulſe feeble, wine ſhould be exhibited as the moſt effectual cordial. In other reſpects, the treatment ſhould be ſuch as proves moſt beneficial in ſimilar affections of other parts of the body; but as this has already been fully taken notice of in a preceding chapter, it is not neceſſary to enter upon it again *.

Before leaving the ſubject that we are now conſidering, I think it right to notice a practice that has prevailed in the treatment of this kind of injury, which ought in my opinion to be laid aſide; namely, the indiſcriminate uſe of the trepan in the inflammatory as well as in the purulent or ſuppurative ſtage of theſe ſymptoms. It has been common, in all caſes of this kind, in the firſt place to preſcribe large evacuations; and if theſe do not procure relief, to apply the trepan immediately, whatever may be the ſtage of the diſeaſe.

This practice is chiefly founded on an idea that has prevailed with ſome, of the operation of the trepan being an innocent remedy, and of no harm being ever produced by it. In ſupport of this opinion, experiments are related of the operation having been performed in ſound animals, with a view to determine the queſtion, Whether expoſure of the brain to the air is

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* *Vide* Treatiſe on Ulcers.

is detrimental or not? And as it has happened in ſeveral inſtances, that no bad effects have enſued, a general concluſion has been drawn in favour of the operation.

But were we for a moment diſpoſed to admit the truth of this concluſion, yet one great objection to the application of the trepan in an inflamed ſtate of the brain, would occur,—that no benefit could be derived from it. The ſole object we ſhould ever have in view from this operation, is to remove preſſure from the brain: But in an inflamed ſtate of this organ, as no preſſure is ſuppoſed to exiſt, the remedy is of courſe unneceſſary.

If practitioners would allow themſelves to be directed by the effects of thoſe remedies that prove uſeful in ſimilar affections of other parts of the body, inflammation of the brain would never be treated in this manner: We need not ſurely expect to derive advantage from perforating the cheſt in the firſt ſtage of an inflammatory affection of the pleura; nor would any ſurgeon adviſe it till the formation of matter was fully indicated.

Beſides this, however, I am decidedly of opinion, that the trepan cannot be applied in inflammation of the brain, but with manifeſt hazard: It tends always to increaſe the ſymptoms of inflammation; and in almoſt every inſtance in which I have known it employed during this ſtate of the diſeaſe, the dura mater has been found, after death, either in a ſtate of mortification, or covered with purulent matter.—Theſe effects we may ſuppoſe to be in ſome meaſure the conſequence of admiſſion of air to the brain; and they may be partly owing to the violent ſeparation of a portion of the cranium from the inflamed dura mater, to which it adheres firmly in almoſt every point.

Neither is this the only ground on which I would object to the practice: Contrary to the received opinion, I think that the operation of the trepan is in itſelf dangerous, even when performed in a ſound ſtate of the brain, where no inflammation takes place.—Several years ago I made a variety of trials to determine this point; and nearly one-fourth of the animals that underwent the operation, appeared to die from the effects of it.

It is not, however, from the effects of this operation on other animals alone, that I wiſh to draw any concluſion; but when conſequences ſimilar to what I have ſtated, reſult from it when performed on the human body, when no immediate injury has been done to the head, they will be allowed to have much weight in eſtabliſhing the opinion I have advanced.—I have accidentally met with three caſes much in point, in none of which there was any appearance of inflammation of the brain previous to the operation; and yet, two of the patients died in a few days after the perforation of the ſkull, evidently from inflammation induced upon the dura mater. As caſes of this kind do not often occur, and as the reſult of theſe tends to eſtabliſh the validity of the opinion I have advanced, I ſhall here give a ſhort account of them.

In caſes of inveterate epilepſy, where every other means of relief have failed, it has been propoſed, to admit the free preſſure of the atmoſphere to the ſurface of the brain, by one or more perforations made in the ſkull with the trepan. Any advantage to be obtained from this, I muſt acknowledge to be extremely doubtful; and the effects of it appear to me to be ſo uncertain, and even hazardous, that I ſhould never think of adviſing it. But it has ſo happened, that I have known two inſtances of its being done by others; and in a third, I had occaſion to put it in practice myſelf, in the caſe of a gentleman who had laboured under epilepſy for upwards of twenty years. But in this caſe, as the fits appeared to be the conſequence of an injury received in childhood upon the forehead; as the external appearance of the part on which the injury was inflicted, gave cauſe to ſuſpect that a ſmall portion of the ſkull was depreſſed at this place; as there was ſome reaſon, therefore, to ſuppoſe, that the fits depended upon this cauſe; and as they were at this time become extremely violent, it was the opinion of ſeveral practitioners of this place, as well as the earneſt deſire of the patient, that the trepan ſhould be employed. This was accordingly done; the portion of the ſkull which received the blow was taken out; and matters went on very favourably till the end of the ſecond day from the operation, when ſymptoms of inflammation occurred; and, notwithſtanding all the remedies that were employed, he died in little more than forty-eight hours from this period. On opening the head, a great quantity of pus was found, not only on the dura mater, but on the pia mater, and even between this membrane and the brain; and as there was not, till within twenty-four hours of his death, any ſymptoms of a compreſſed brain, there is much reaſon to think that the matter was formed merely in conſequence of inflammation induced by the operation; and therefore, that the means employed for the patient's relief had evidently haſtened his death.

One of the others on whom the operation was performed, recovered from the immmediate effects of it, but with no alteration or abatement of the fits for which it was employed. The other died on the ſeventh day from the operation: Symptoms of inflammation appeared on the third; and theſe were at laſt ſucceeded by evident marks of a compreſſed brain: A conſiderable quantity of matter was found between the dura and pia mater, and even beneath this membrane, not merely on the parts contiguous to the wound, but over the whole ſurface of the brain.

We have here two caſes, very diſtinctly marked, of the hurtful effects of this operation, even in a ſound ſtate of the brain, at leaſt where no previous inflammation appeared to exiſt in it. The ſymptoms of inflammation which ſupervened in both inſtances, were evidently the effect of the perforations: Suppuration enſued in both;

and as both the patients died in the ſpace of a few days from this period, no doubt can be entertained of the cauſe of it.

I am therefore induced to conſider the operation of the trepan as inexpedient, and even dangerous, in an inflamed ſtate of the brain: But when ſuppuration has taken place, and when matter formed within the ſkull operates as a cauſe of compreſſion, as this operation affords the only chance of ſafety, it ſhould be employed with freedom, and without heſitation. —We proceed now to the conſideration of Fiſſures, or ſimple Fractures of the Skull.

§ 2. *Of Fiſſures, or ſimple Fractures of the Skull.*

The term Fiſſure is here meant to imply a mere diviſion or ſimple fracture of the ſkull not attended with depreſſion; and it may either penetrate the whole thickneſs of the bone, or be confined to one lamella of it only: A fiſſure may alſo be attended with a diviſion or wound of the correſponding teguments, or theſe may be left entire.

I have already had occaſion to remark, that injuries done to the head, prove hazardous nearly in proportion to the violence which the brain receives from them: So that fiſſures, in ſo far as they affect the ſkull only, are not to be conſidered as dangerous; but being frequently combined with affections of the brain from the beginning, and on other occaſions productive of conſequences from which this organ is ultimately brought to ſuffer, they of courſe require our moſt ſerious attention. It often indeed happens, that very extenſive fiſſures heal without any bad ſymptom taking place; but as others which are apparently trivial, frequently terminate in the moſt fatal manner, we cannot with propriety in any inſtance treat them with neglect.

Fiſſures of the ſkull may prove dangerous, either from being productive of effuſions of blood or ſerum upon the brain, or by tending to excite inflammation of the dura and pia mater.

When effuſions take place, as this muſt be attended with ſymptoms of compreſſion, thoſe means ſhould be adviſed that are known to be beſt ſuited for its removal; but as theſe have been already fully treated of in the preceding ſections, it is not neceſſary to enter into a further detail of them: I ſhall juſt ſhortly obſerve, that for the removal of theſe effuſions, we have to truſt entirely to a proper application of the trepan. The fiſſures ſhould be traced through their whole extent; and a perforation being made in the moſt depending part of each of them, if this does not prove ſufficient, the operation ſhould be repeated along the courſe of the fractures, as long as any ſymptoms continue of a compreſſed ſtate of the brain; care being always taken to include the fiſſure in every perforation: For, as the cauſe of the miſchief will in general be found contiguous to the fracture, it would ſeldom anſwer any good purpoſe to perforate the ſkull in any other part.

It is therefore ſcarcely neceſſary to obſerve, that care ſhould be taken to trace the courſe of the fiſſures with much accuracy; for which purpoſe, as ſoon as we reſolve on performing the operation, if the whole extent of the fracture has not been previouſly diſcovered, it ſhould now be done by making an inciſion through the ſkin and other teguments down to the pericranium: and by taking care to follow the direction of the fiſſures, they may thus be brought freely in view.

When fiſſures are of ſuch magnitude as to produce an obvious ſeparation of the two ſides of a fractured bone, the nature of the caſe at once becomes obvious; but it often happens, that they are ſo ſmall as to render the operator doubtful and uncertain. A little attention, however, to the real ſtate of the patient, will at all times prevent any heſitation reſpecting the means that we ſhould employ.

The only appearances with which a fiſſure is in danger of being confounded, are, thoſe indentations formed on the external ſurface of ſome parts of the ſkull by the blood-veſſels which run upon it; and the different ſutures which ſerve to unite the bones of the ſkull together.

In doubtful caſes of fiſſure, we may frequently be determined by the degree of adheſion that takes place between the pericranium and ſkull. The pericranium, as we have ſeen, naturally adheres firmly to every part of the ſkull, and particularly at the ſutures; and as one certain effect of a fiſſure is to deſtroy this connection entirely, when the pericranium adheres to the bone beneath, we may conclude without heſitation, that no fiſſure exiſts; and, on the contrary, when this membrane is looſe and ſomewhat ſeparated from the bone, there will be much reaſon to ſuppoſe that any rent or crack that appears in it, is produced by a fracture.

It often happens, however, that we are deprived of this means of detecting fiſſures, by the pericranium and other teguments being ſeparated from the bone for a conſiderable ſpace. In this ſituation, various means have been propoſed for obtaining a certainty of the nature of the caſe. By pouring ink over the ſurface of the denuded bone, the whole of it, we are told, may be wiped off, if the bone is not fractured; but, wherever there is a crack or fiſſure, that it will be impoſſible even with the aſſiſtance of water to remove it.

By making the patient keep a firm hold with his teeth of one end of a hair, or of a piece of catgut, while the other extremity is ſecured at ſuch a diſtance as to render it tenſe, if it is now ſtruck, the vibrations thus produced will create, we are told, a very ſenſible degree of uneaſineſs in the part affected, if it is fractured; but will not otherwiſe have any effect. And again it is ſaid, if the patient is made to chew a bit of bread, or any other hard ſubſtance, that ſome pain will occur from it if the bone is fractured; but otherwiſe, that the injured part will not ſuffer.

None of theſe teſts, however, are to be much depended on: neither of the two laſt have any effect, unleſs the fiſſure is extenſive, and the ſides of the fractured bone conſiderably ſeparated from each other, when this means of diſtinction can never be neceſſary; and as ink penetrates the ſutures of the ſkull, unleſs when they are firmly oſſified, it can ſeldom happen that any trial to be made with it will be productive of any advantage.

It commonly happens, in fiſſures extending through the whole ſubſtance of the ſkull, and even in ſuch as penetrate only to the diploë, that blood continues to ooze from them for a long time after the accident, and it conſtantly returns again almoſt as ſoon as it is wiped off: This is one of the moſt characteriſtic marks of a fiſſure, and it points out with preciſion the nature of the caſe. But there is no neceſſity, I may remark, for ſo much anxiety on this point as practitioners commonly expreſs; for, unleſs when ſymptoms of an alarming nature take place, I ſhall preſently endeavour to ſhow that no operation ſhould be adviſed: And again, whenever the ſymptoms indicate a compreſſed ſtate of the brain, if any appearances of a fiſſure are dreaded in that part of the ſkull which has recently received a blow; however equivocal they may be, yet as this is moſt probably the ſeat of the injury, no doubt ſhould be entertained of the propriety of perforating the ſkull at this place. If it ſhould afterwards appear that the trepan has been applied upon a ſuture, as the ſurgeon under ſuch uncertainty would proceed with much caution, no harm could enſue from it; and if it ſhould prove to be a fracture, it would afford him much ſatisfaction to find that the perforation had been made where alone it could prove uſeful.

But although I have in this place, as well as in other parts of theſe obſervations, adviſed the trepan as the only remedy to be truſted for the removal of ſymptoms of a compreſſed brain; yet unleſs where ſymptoms of this kind take place, even the preſence of a fiſſure ought not to indicate the operation: But as this is a point upon which I happen to differ from many of the profeſſion; and as it is of much practical importance to have it duly conſidered; I ſhall advert to it with more minuteneſs, than might be otherwiſe neceſſary.

Hitherto it has been a general rule, to conſider the application of the trepan as neceſſary in every fiſſure, whether any ſymptoms of a compreſſed brain have occurred or not. But due attention to the real nature of a fiſſure, and to the effects moſt likely to reſult from perforating the ſkull, will ſhow, that although fiſſures may be frequently combined with ſuch ſymptoms as require the trepan, yet that they are not always or neceſſarily ſo; and unleſs when ſuch ſymptoms actually exiſt, that this operation, inſtead of affording relief, muſt frequently do harm: for it is by no means calculated for, or in any reſpect adequate to, the prevention of theſe ſymptoms; and I have already endeavoured to ſhow, that laying the brain bare is never to be conſidered as harmleſs; and therefore that it ſhould never be adviſed but when it is probable that ſome advantage may be derived from it.

When a fiſſure is attended with a compreſſed ſtate of the brain, there can be no heſitation, as I have obſerved already, in recommending an immediate application of the trepan: But in the caſe of a fiſſure not accompanied with any ſymptom of this kind, and while the patient complains of nothing but perhaps a ſlight degree of pain in the contuſed part, an occurrence by no means unfrequent; what advantages are we to expect from perforating the ſkull? In this ſituation, we know, that no extravaſation takes place; and that no part of the ſkull is depreſſed, otherwiſe ſymptoms would occur of a compreſſed ſtate of the brain: For what purpoſe, therefore, ſhould the trepan be applied? No ſufficient reaſon, I believe, can be adduced for it.

In the caſe of a ſimple fiſſure, not attended with any bad ſymptoms, the moſt alarming occurrence that we have to dread is the acceſſion of inflammation; for it frequently happens, that the membranes of the brain become afterwards inflamed, although the patient may have remained perfectly well for ſeveral days, nay, even for weeks, after the injury producing the fracture was inflicted. Now, whoever attends to one of the immediate effects of the trepan, namely, the violence done by it to the dura mater, together with the admiſſion of air to the parts within the ſkull, muſt acknowledge, that this tendency to inflammation, the circumſtance which, of all others, we have moſt cauſe to dread, inſtead of being leſſened by this operation, muſt, in all probability, be increaſed; ſo that, as a preventative of bad ſymptoms, it ought never to be adviſed.—It has, indeed, been keenly held forth by thoſe who ſupport a contrary opinion, that, in fiſſures of the ſkull, no additional riſk can be incurred by this operation; for it is ſaid, that air being already admitted to the brain by the fracture itſelf, the trepan will not give it a more free acceſs, while at the ſame time, they obſerve, that it is attended with the very important advantage of forming and preſerving a free vent for any matter that may form between the ſkull and dura mater during the cure.

This argument is ſpecious, but it will not on examination be found to merit attention. For, when fiſſures are ſo extenſive as to produce any obvious ſeparation between the ſides of the fractured bone, a more ſufficient vent is thus procured for any matter that may form than could poſſibly be obtained by an operation: And again, in fiſſures of leſſer extent, as they do not always terminate in the formation of matter beneath the ſkull, but, on the contrary, as they frequently do well without the occurrence of any bad ſymptom, it cannot ſurely be conſidered as prudent to adviſe a hazardous operation, merely for the chance of its becoming neceſſary. And beſides, inſtances are often met with, in which fiſſures penetrate no deeper than the external table of the ſkull; a circumſtance which cannot be previouſly known; and for which even the warmeſt ſupporters of the practice in queſtion would never ſurely recommend a perforation through the whole ſubſtance of the bone.

The idea that has hitherto very univerſally prevailed, of the harmleſs nature of this operation, has probably been the chief cauſe of the opinion reſpecting the propriety of performing it in every caſe of fiſſure: But, if the opinion that I have given is well founded, any utility probably to be derived from it, will be more than counterbalanced by the hazard with which we ſuppoſe it to be at all times attended.

Whilſt no bad ſymptoms ſupervene, a fiſſure of the ſkull ſhould be treated, merely as a cauſe that may give riſe to inflammation. The patient ſhould loſe blood once and again, in proportion to his ſtrength; his bowels ſhould be kept open; the ſore ſhould be treated with mild dreſſings; and as long as there is cauſe to ſuſpect that inflammation may occur, violent exertion of every kind ſhould be avoided: For although, in ſuch circumſtances, I would not, for the reaſons that I have given, adviſe the common practice of perforating the ſkull in every caſe of fiſſure, I am perfectly decided in this, that fiſſures ſhould always be treated with attention, and ſhould have the moſt effectual means employed for obviating thoſe effects that ariſe from them when inflammation takes place.

By the means that I have pointed out, a cure will frequently be obtained, without putting the patient to the hazard ariſing from the operation of the trepan; but when, from the violence of the injury, or from any other cauſe, they are found to fail, and that the inflammation terminates in ſuppuration, as in ſuch circumſtances nothing but a free diſcharge to the matter can ſave the patient, this operation will now with much propriety be employed: But, for the reaſons I have already advanced, I muſt again ſay, that till this ſtage of the diſeaſe takes place, the perforation of the ſkull ought never to be adviſed. The arguments adduced in ſupport of this opinion in different parts of this and the preceding ſections are perhaps of themſelves ſatisfactory; but in a point of ſuch importance, no perſon ſhould ſpeak deciſively on any opinion not ſupported by experience. When the reſult of experience, however, is ſupported by probability, we more readily give our aſſent to it than could ever be done to a mere practical fact; and as all the obſervation I have been able to make reſpecting the point we are ſpeaking of, tends to ſupport the practice that I have adviſed, it is without heſitation that I venture to propoſe it.

SECTION VI.

Concluſion.

THE importance of the ſubject that we have juſt been conſidering, together with the intricacy in which it is involved, has led to a length of diſcuſſion which I did not at firſt expect: If, however, in treating of injuries done to the head, I have in any degree contributed to remove the perplexity that has hitherto obſcured the ſubject, ariſing, as well from the complicated nature of the injuries themſelves, as from the manner in which authors have generally handled them; the time I have ſpent, and the pains I have taken, will not be thought miſapplied.

The length to which this chapter has extended, points out the propriety of bringing the more material parts of the ſubject into one point of view: On this account, the following recapitulation is ſubjoined.

1. It appears, that in a ſtate of health, the cavity formed by the bones of the ſkull is completely filled with the brain and its membranes.

2. That a direct communication takes place between the external coverings of the ſkull and the parts contained within it, by means of blood-veſſels paſſing between the dura mater and the pericranium, eſpecially at the different ſutures.

3. From this mechaniſm, we may perceive, how the ſmalleſt diminution of the cavity of the ſkull, however it is produced, muſt always occaſion compreſſion of the brain: And from it alſo we account for the ready communication of inflammation from the external teguments of the ſkull to the dura mater.

4. The various ſymptoms ariſing from injuries done to the head, may be refer-

red to three general effects; compreſſion, concuſſion, and inflammation of the brain.

5. In a compreſſed ſtate of the brain, the ſafety of the patient depends ſolely upon the removal of the cauſe by which the compreſſion is produced. When a portion of the bone is beat in, and is at the ſame time ſo looſe as to admit of its being taken out with the fingers of the operator, with common forceps, or perhaps a levator, theſe only ſhould be employed: But when the depreſſed portion of bone is firmly fixed, or when the compreſſion is produced by the effuſion of blood, or formation pus, a proper application of the trepan can alone afford relief; and we ought not to heſitate in employing it.

In ſuch circumſtances, the patient is in a very hazardous ſituation; and perforating the ſkull with the trepan as frequently as may be neceſſary, may prove, as it often has done, a very effectual remedy.

6. We are by no means, however, to imagine, as many have done, that a ſur-

geon has accompliſhed all that may be proper for him to perform, on the operation being finiſhed. Indeed, little advantage will in general be derived from it, if other circumſtances are not kept in view. As the cauſe producing the compreſſion, whatever it may be, muſt injure the membranes of the brain, care ſhould be taken, as far as it can be done, to obviate the effects of it. No doſſils, or ſyndons as they are termed, ſhould be crammed into the perforations made by the trepan, and every irritating application ſhould be avoided. The whole ſurface of the ſore ſhould be lightly covered with ſoft lint ſpread with any emollient ointment; and this, with a compreſs of ſoft linen, ſhould be retained by a common night-cap, as the eaſieſt and beſt bandage that can be applied to the head. The patient ſhould loſe blood in proportion to his ſtrength; his bowels ſhould be kept open; his ſkin ſhould be preſerved ſoft and perſpirable; a low diet ſhould be recommended; and he ſhould be kept free from noiſe and every kind of diſturbance.

7. When ſymptoms ariſing from external violence done to the head, depend on concuſſion or commotion of the brain; as this ſeems to operate chiefly by inducing debility of the whole ſyſtem, the common practice of diſcharging much blood, and giving ſtrong purgatives, ſhould be avoided.

Inſtead of this, a moderate uſe of wine, as well as other cordials, ſhould be adviſed, together with a nouriſhing diet; whilſt bliſters and other ſtimulants ſhould be applied to the head itſelf. In long continued affections proceeding from this cauſe, ſuch as loſs of memory and imbecility, electricity may be ſafely employed. I have known ſome inſtances where it appeared to prove uſeful.

8. In the treatment of injuries done to the head, it ſhould always be kept in view, that inflammation of the membranes of the brain very ſeldom takes place immediately, but is apt to ſupervene at ſome diſtant

period from the injury being received: In conſequence of which, accidents which do not at firſt appear to be of much importance, frequently terminate fatally at laſt.

Where inflammation has taken place, we depend chiefly on general and local blood-letting, carried as far as the ſtrength of the patient will permit. Strong purgatives ſhould be adviſed: Sudorifics prove ſometimes ſerviceable; and when the patient is reſtleſs, and diſtreſſed with violent pain, opiates frequently prove uſeful.

When an inflamed ſtate of the brain ſucceeds to a contuſed wound of the external teguments, warm emollient poultices are the beſt applications we can make to the ſore. By inducing a diſcharge of matter from the neighbourhood of the inflamed parts, they prove often highly ſerviceable; and, when the ſkin has not been divided by the contuſion, it ſhould be laid open upon the firſt appearance of a tumor, without expecting or waiting for a complete ſuppuration.

In recommending this treatment, I have departed from the common mode of practice, which directs the immediate application of the trepan if blood-letting and other evacuations do not afford ſpeedy relief; and I have done ſo for two reaſons. In the real inflammatory ſtate of the membranes of the brain, compreſſion of that organ does not take place: It is not indicated by the ſymptoms which take place, nor is it met with on diſſection in ſuch patients as die in this ſtage of the diſeaſe: Perforating the ſkull therefore in this ſituation can do no good. And farther, the operation of the trepan in itſelf, is not, as is generally imagined, innocent and harmleſs. By admitting a free acceſs of air to the membranes of the brain, it tends evidently to excite and promote inflammation in the parts beneath. Applied therefore in this caſe, the trepan may aggravate, but cannot relieve, the complaint for which it is uſed.

9. When, notwithſtanding all our endeavours, the formation of pus takes place,

either upon the ſurface of the dura mater, or within this membrane, it falls in every reſpect to be treated as effuſion induced in any other way. In this ſituation, the operation of the trepan is indiſpenſably neceſſary; for by no other means can the matter be diſcharged, or the ſafety of the patient inſured.

In performing this operation, inſtead of removing a conſiderable portion of the ſkin and other teguments, as has commonly been done, a ſimple inciſion upon the part in which the inſtrument is to be applied is all that is neceſſary; and no more of the pericranium ſhould be removed than is required for this purpoſe.

10. During the progreſs of the cure, after the application of the trepan, fungous excreſcences are apt to ſhoot out from the different perforations in the bone. There is ſeldom, however, any reaſon for our attempting to remove them, as is commonly done, by compreſſion, cauſtic, or ligature; for in general they diſappear ſoon after the oſſifying proceſs is completed in the ſeveral

openings. But when this does not happen, and when they ſtill continue to prove troubleſome after the reſt of the cure is accompliſhed, they may with ſafety be taken away, either with cauſtic or the ſcalpel.

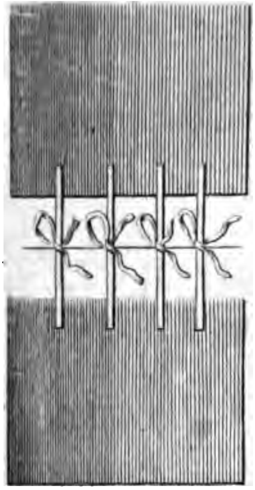
In various points of importance treated of in this chapter, I have advanced opinions, and recommended modes of treatment, different from thoſe which hitherto have prevailed: But however diffident I am in firſt diſſenting from an eſtabliſhed doctrine, if my own experience is found to juſtify this diſſent, the more reſpectable the authority by which the contrary opinion is ſupported, the more inveſtigation appears to me to be neceſſary.

But in propoſing modes of practice different from what are ſanctioned by long cuſtom, I have never been conſcious of being actuated by a ſpirit of innovation, or a deſire of appearing ſingular: And whenever I have ventured to diſſent from men of known abilities, I have always endeavoured, with fairneſs and candour, to ſtate the reaſons of my doing ſo, and the grounds upon which my opinions are formed: At leaſt this has been my intention, and I hope it will appear to others that I have done ſo.

END OF VOLUME THIRD.

PLATE I.

Fig. 1.



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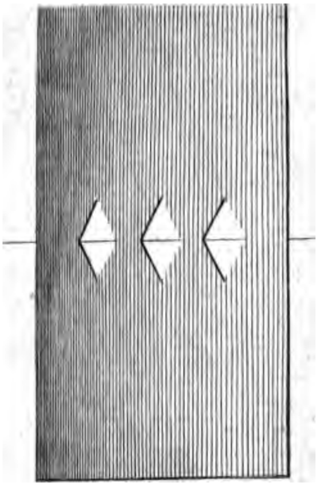


Fig. 3.

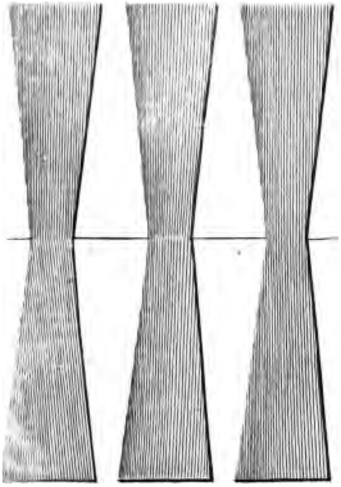
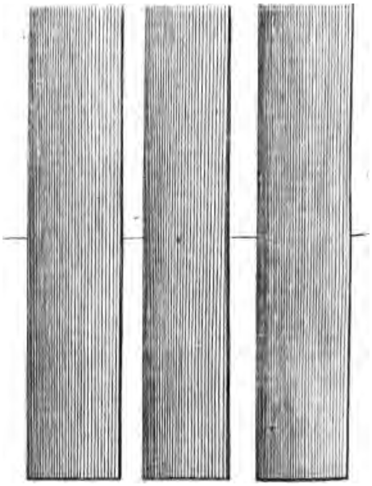


Fig. 4.



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EXPLANATION

OF THE

PLATES.

Plate I.

ALL the figures of this Plate repreſent the edges of wounds, drawn together and retained by adheſive plaſters; for an account of which ſee Volume I. Chapter III. Section II. when treating of the cure of ſimple inciſed wounds.

PLATE II.

The figures in this Plate repreſent an apparatus for the cure of a rupture of the Tendo Achilles; of which an explanation is given in Volume I. Chapter III. Section VII.

PLATE III.

Figs. 1. and 8.—Two forms of a tenaculum, for the purpoſe of pulling out blood-veſſels to be tied with ligatures.

Figs. 2. and 4.—Two needles, ſomewhat different in the curve from thoſe in common uſe: The handles being nearly ſtraight, they are thereby managed with more eaſe than the others, particularly in deep wounds.

PLATE II.

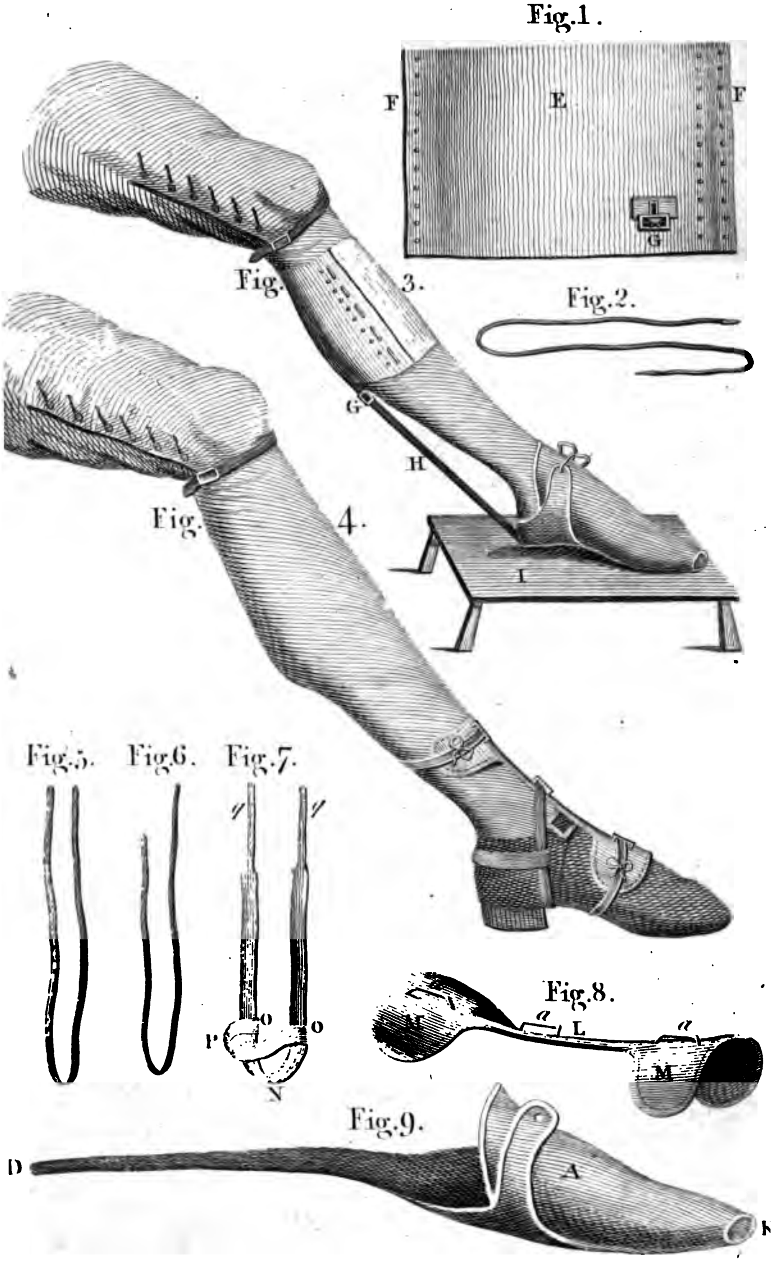

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PLATE III.

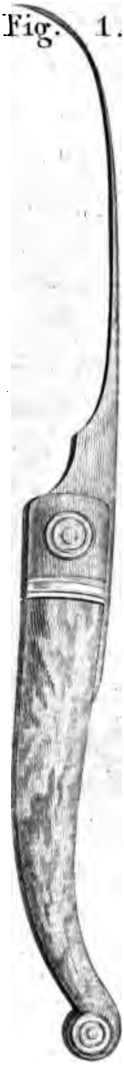


Fig. 1.

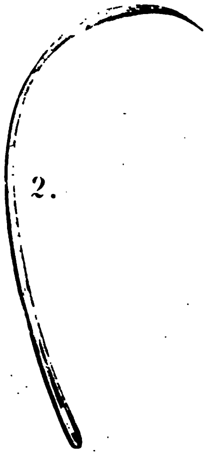


Fig. 2.

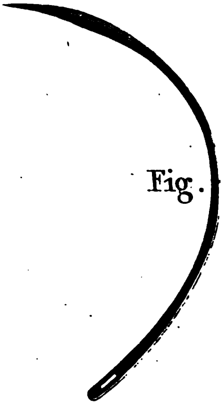
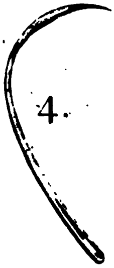


Fig. 3.



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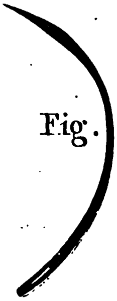

Fig. 5.

Fig. 6.

Fig. 7.

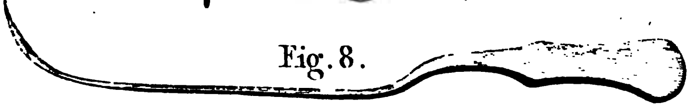

Fig. 8.

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Figs. 3. and 5.—Two needles of the uſual form, but neither theſe nor the other two have an edge on their concave parts. They are ſomewhat round like a lancet, both on their convex and concave ſides; which adds to their ſtrength, and makes them enter with more eaſe than the thick round form of the others.

Figs. 6. and 7.—Two ſtraight needles for ſutures of the inteſtines, and other delicate parts.

Many inſtruments have been propoſed for holding needles, when employed in deep wounds: The porte-aiguille, repreſented in Plate IV. fig. 1. anſwers this purpoſe as well as any other, but inſtruments of this kind are ſeldom needed. All theſe inſtruments are repreſented of a proper ſize for uſe.

PLATE IV.

Fig. 1.—A Porte-aiguille, mentioned in the explanation of Plate III.

Figs. 2. 3. and 4.—Gold pins, uſed in the twiſted ſuture, deſcribed iu Volume III. Chapter VI. Section V.

Fig. 6.—A gold pin, with a ſteel-point, alſo uſed for the twiſted ſuture.

Fig. 7.—A moveable point of ſteel, fitted to the gold pin, fig. 8.

Fig. 5.—A flat needle, ſometimes uſed in ſecuring blood-veſſels contiguous to bones.

All theſe inſtruments are here of a full ſize for uſe.

PLATE IV.

Fig. 1.

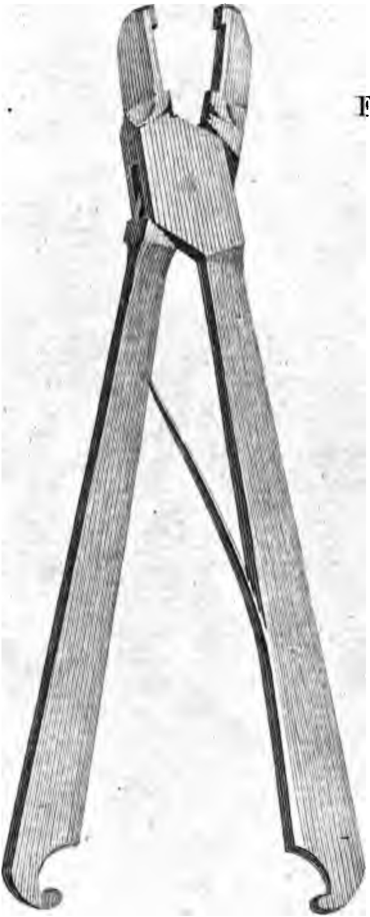

Fig. 2.

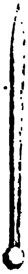

Fig. 3.

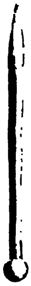

Fig. 4.

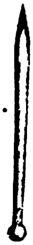

Fig. 5.

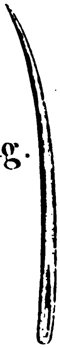

Fig. 6.

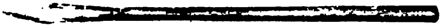

Fig. 7.

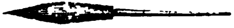

Fig. 8.

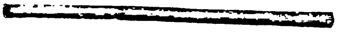

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PLATE V.

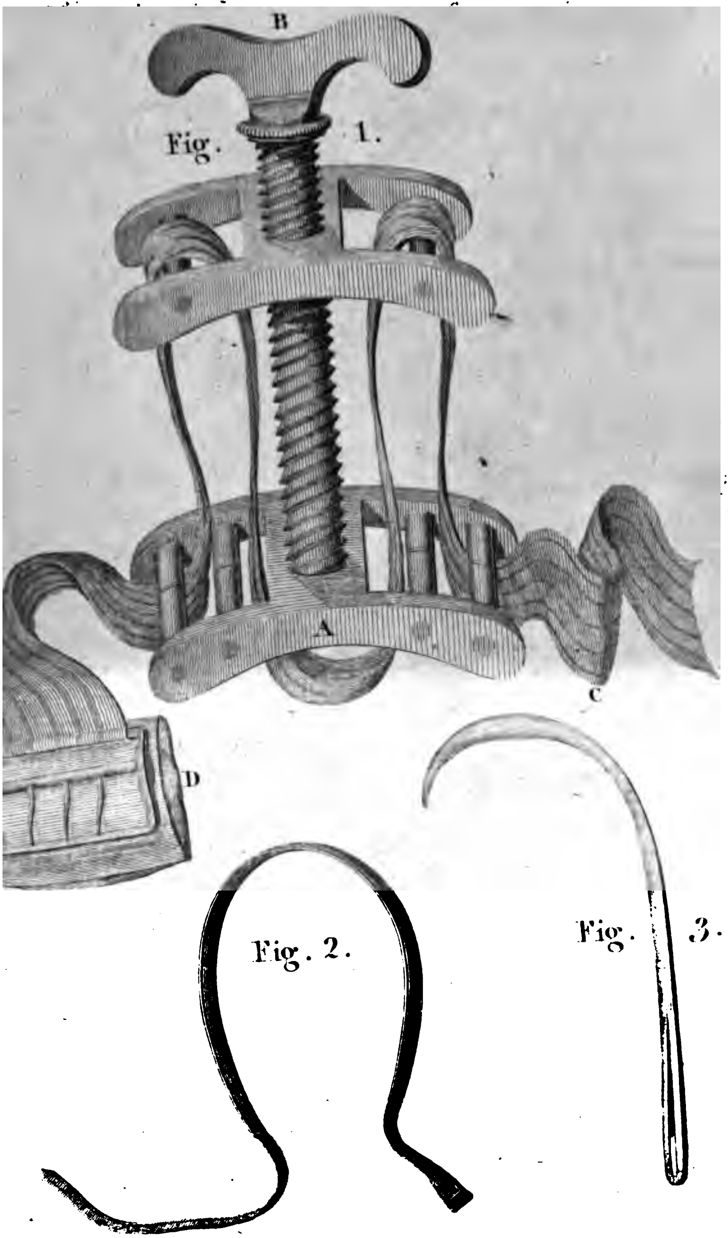

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PLATE V.

Fig. 1. A ſcrew tourniquet, deſcribed in Volume III. Chapter VII. Every part of this inſtrument is repreſented of the full ſize. It may either be made of braſs or ſteel, and the ſtrap ſhould be of ſtrong unyielding materials, at leaſt an inch broad, and of a length ſufficient to paſs eaſily round the largeſt circumference of any of the extremities.

Fig. 2. A bandage for compreſſing the temporal artery. It is made of a well-tempered ſteel ſpring, covered with ſoft leather, and of the ſame ſtrength with what is uſed for the truſs of a hernia. It ſhould be three quarters of an inch broad, and fourteen or fifteen inches in length. I once had a ſcrew, fitted with a button to this bandage, the button, by

PLATE VI.

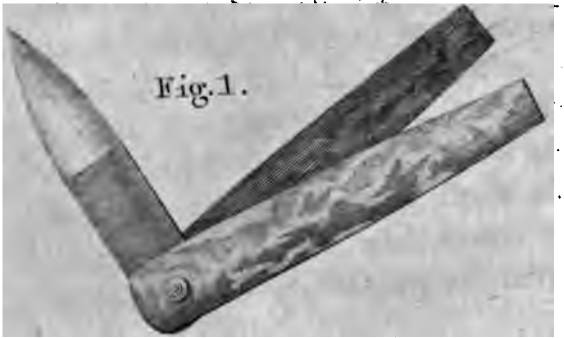

Fig. 1.

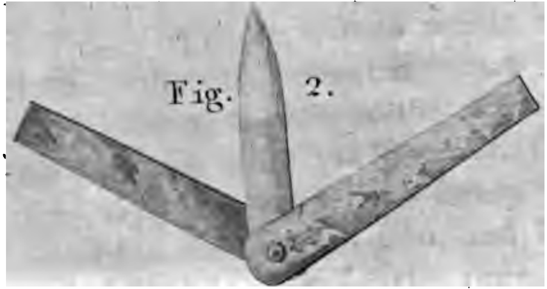

Fig. 2.

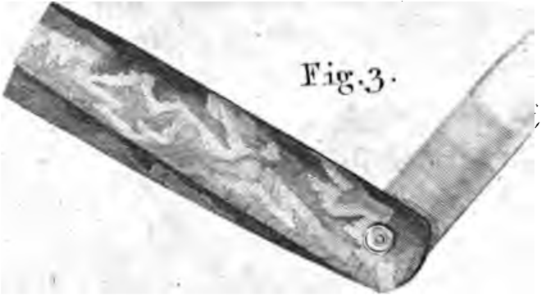

Fig. 3.

Fig. 4.

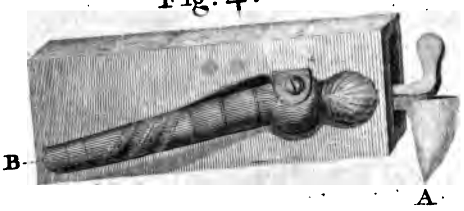

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PLATE VI.

Figs. 1. and 2.—The beſt forms of lancets for the operation of blood-letting, deſcribed in Volume III. Chaper XIII. Section I.

Fig. 3. repreſents the broad-ſhouldered lancet in common uſe, but which, from its form, is evidently ill-ſuited for this nice operation.

Fig. 4.—A ſpring fleme, alſo deſcribed in Chapter XIII. Section I.

Plate VII.

Fig. 1. A ſcarificator with ſixteen lancets; the different parts of which are ſo generally well known, that it is not neceſſary to deſcribe it.

Fig. 2. A cupping glaſs, fitted with an exhauſting ſyringe, for the purpoſe of extracting blood from wounds made by the ſcarificator, fig. 1.

Figs. 3. and 4. The different parts of fig. 2. repreſented ſeparately.

Plate VIII.

Fig. 1. This figure repreſents the inſtrument, commonly named a trepan. As the

PLATE VII.

Fig. 1.

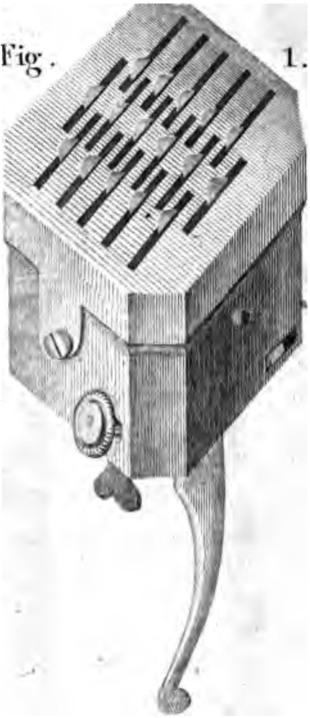

Fig. 2.

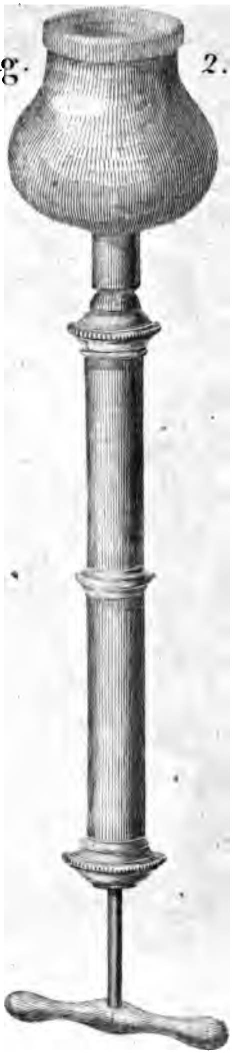

Fig. 3.

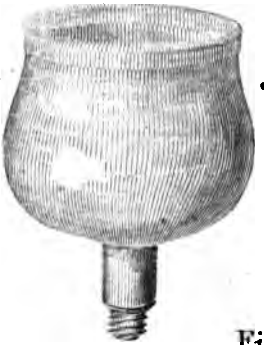

Fig. 4.

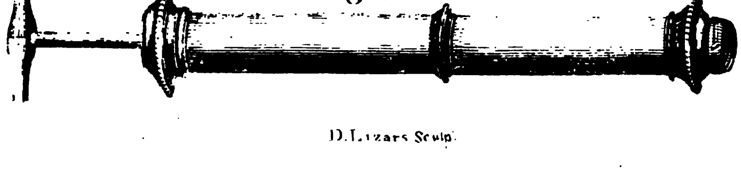

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PLATE VIII.

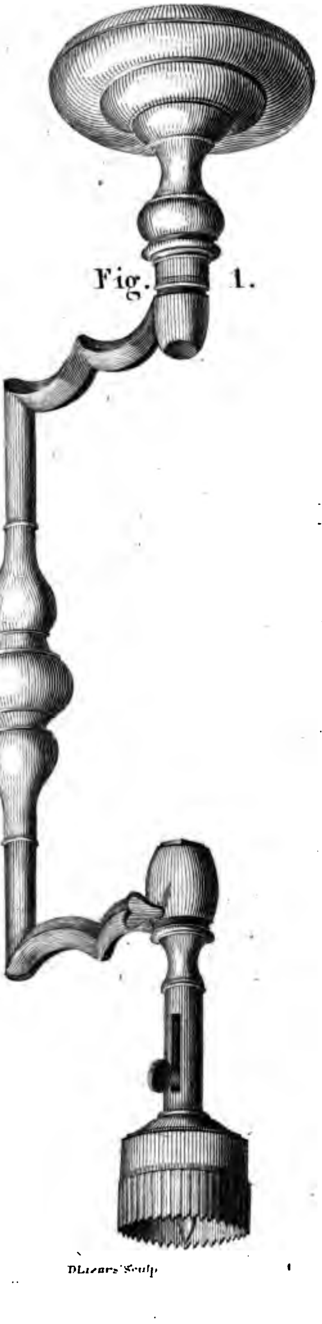
Fig. 1.

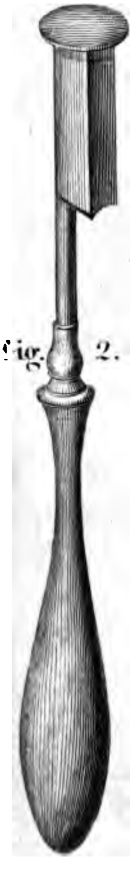
Fig. 2.

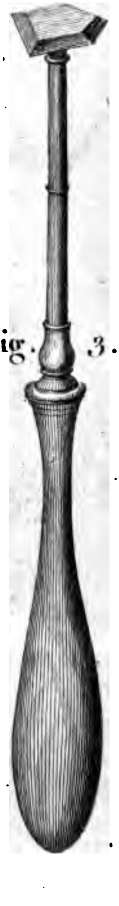
Fig. 3.

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the page does not admit of the full ſize, every part of it is about one-third leſs than it ought to be. The upper part of the handle is of timber; the reſt ſhould all be poliſhed ſteel.

For reaſons that I have given in Chapter X. Volume III. every operator ſhould be provided with this inſtrument as well as with the trephine, Plate IX. fig. 1. the ſame heads being made to fit both inſtruments.

Fig. 2. This inſtrument is commonly termed a lenticular. It is uſed by ſome for ſcraping the edges of the opening in the bone formed by the trepan, when they are found to be rough and unequal: For this purpoſe, it is ſharp on one ſide, and the button on the top is meant to protect the brain, and to receive the pieces that fall from it. There is rarely, however, any cauſe for uſing it: I have never found it neceſſary, but I have given a view of it,

as it forms part of the apparatus of every ſurgeon for the operation of the trepan.

Fig. 3. A raſpatory for removing the pericranium, before applying the trepan; but no more of the ſkull ſhould ever be denuded than is merely neceſſary for the purpoſe.

PLATE IX.

Fig. 1. A repreſentation of the trephine of a full ſize for uſe.

Fig. 2.—Forceps for the purpoſe of removing detached portions of a fractured ſkull. They are alſo uſed for taking out pieces of the ſkull that have been ſeparated or cut out by the trephine, when they do not come away in the head of the inſtrument.

Fig. 3. A head of a trephine with larger teeth than the inſtrument in common uſe;

PLATE IX.

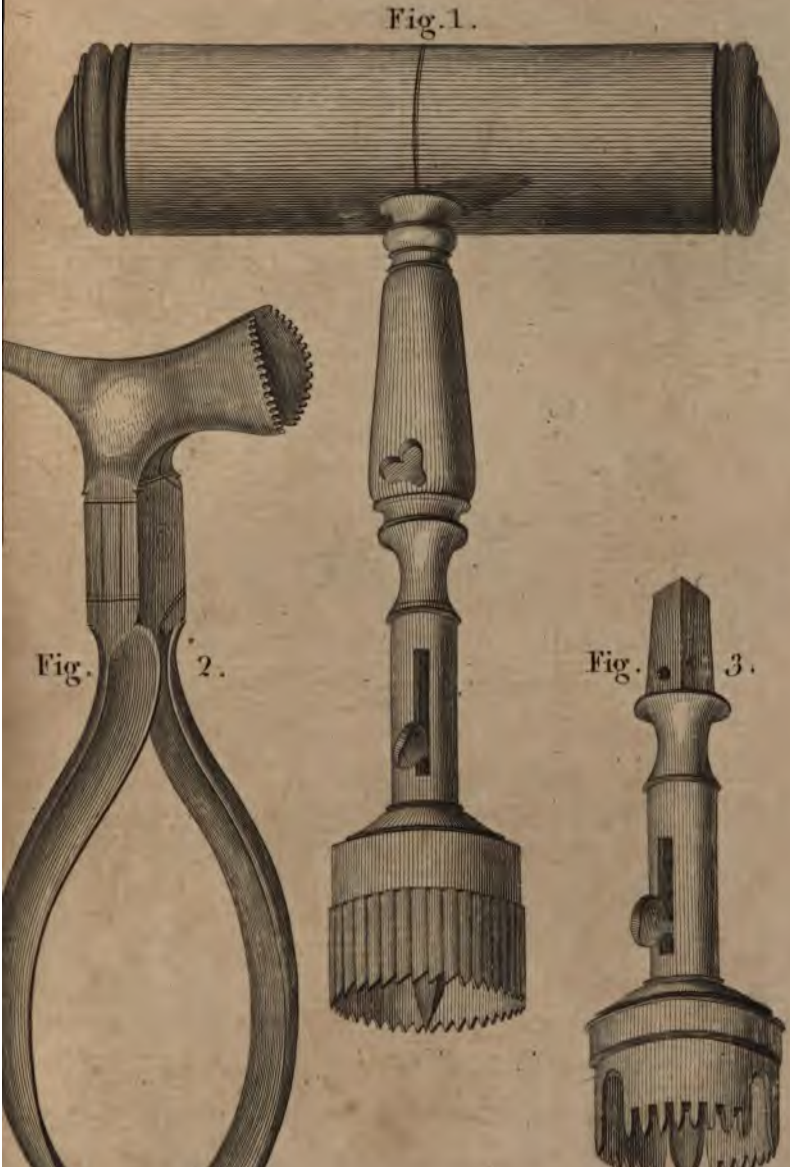

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PLATE X.

Fig. 1.

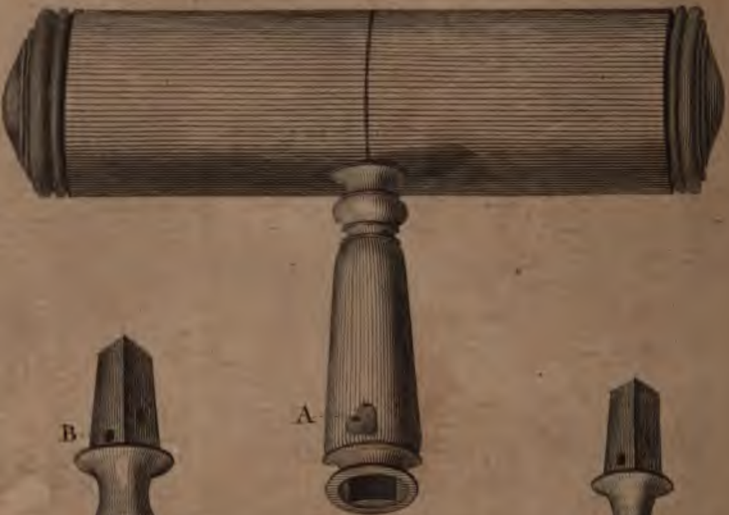


Fig. 2.

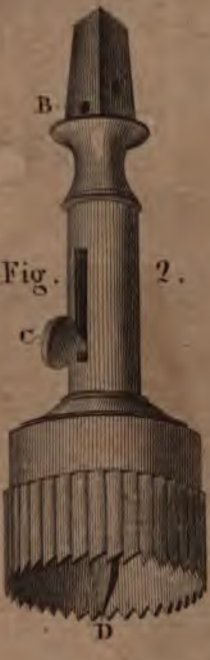


Fig. 4.

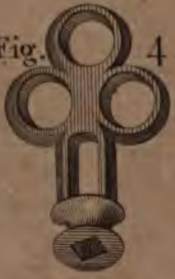


Fig. 3.

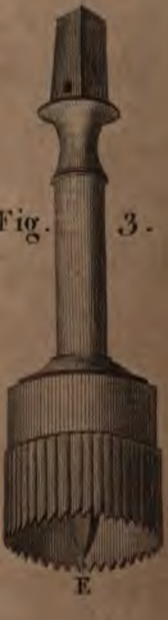
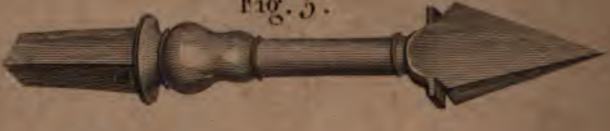


Fig. 5.



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uſe; and along the courſe of the ſaw, there are three vacuities in which the teeth are entirely wanting: By this it is ſuppoſed that a piece of bone may be cut out more quickly than with the common trephine, and that the inſtrument need not be ſo frequently removed for the purpoſe of being cleared of the ſmall fragments of bone produced by the ſaw: When the teeth of this ſaw are firm and properly ſet, it cuts both quickly and ſmoothly, but not better than the inſtrument in common uſe.

PLATE X.

The figures in this plate repreſent all the parts of the trephine ſeparately.

Fig. 1. The handle of the trephine, which ſhould be made of timber, and of the form here repreſented.

Fig. 2. The ſaw or head of the trephine: The upper part of it ſhould fit

with much exactneſs an opening in the under part of the handle, ſo that when inſerted into it the hole *B* may be oppoſite to the end of the ſcrew *A*, when by turning the ſcrew *A*, the two parts of the inſtrument may be firmly connected together.

C, The nut of a ſcrew paſſing through a ſlit in the handle of the head, and fixed in the upper part of a moveable pin, *D*. In uſing this inſtrument, the point of the pin *D* is made to project paſt the teeth of the ſaw, till an impreſſion is made upon the ſkull, of a ſufficient depth for retaining it, when the pin ſhould be removed: This is eaſily done, by moving the nut *C* to the upper part of the ſlit, and fixing it there by turning the ſcrew. All the parts of the trephine are here alſo repreſented of a full ſize for uſe: The diameter of the ſaw ſhould not be leſs than an inch. Of this ſize it is uſed with the ſame eaſe as ſaws of the ſmalleſt diameter,

ter, and the opening formed by it being larger, it anſwers the intention of the operator better.

Fig. 3. A head of a ſmall ſize ſuch as is commonly uſed: The pin *E* is in this inſtrument fixed by a ſcrew into the bottom of the head, and is taken out by means of the key, fig. 4. but the method of moving the ſcrew, as repreſented in fig. 2. is in every reſpect better.

Fig. 5. A perforator for forming a ſmall hole in the centre of the piece of bone on which the head of the trephine is to be applied, and into which the pins *D*, *E*, figs. 2. and 3. muſt be inſerted. The perforator ſhould be exactly fitted to the handle of the inſtrument, fig. 1. to which it muſt be fixed by the ſcrew *A* in the manner directed for fixing the head to it.

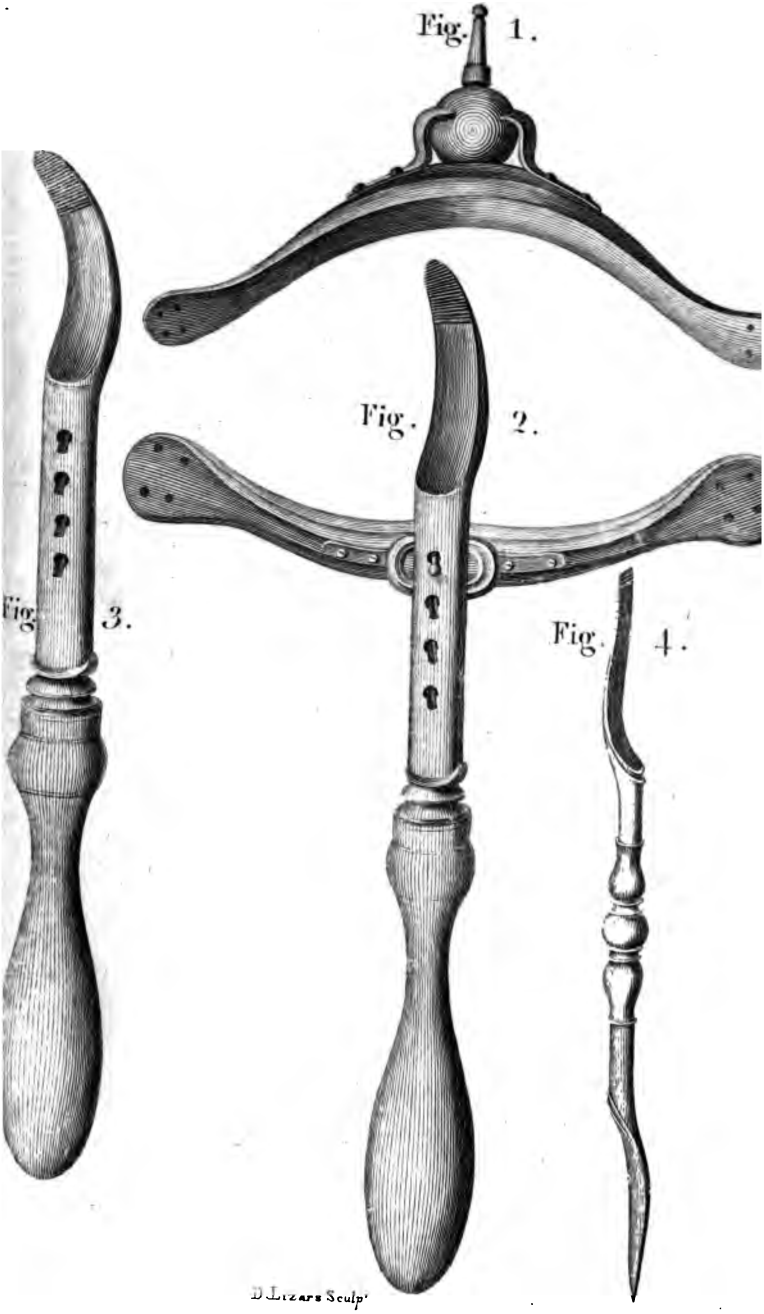
PLATE XI.

Figs. 1. and 2. repreſent the different parts of a levator nearly the ſame with that of Mr Petit. Fig. 1. a frame ſupported by two feet with a pin and moveable ball on the upper part of it: This pin muſt be of a ſize correſponding to the holes in the levator, fig. 3. and the ball ſhould move with freedom in every direction, by which the point of the inſtrument may be carried with eaſe from one part to another, while the frame on which it is fixed is kept firm in its ſituation by an aſſiſtant.

Fig. 2. The two parts of this inſtrument joined together, and ready for uſe.

Fig. 4. The levator in common uſe; but this inſtrument, while it elevates one part of the ſkull, muſt preſs with ſo much

PLATE XI.



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much force upon another, that it never ought to be uſed, eſpecially as the levator, fig. 3. anſwers with perfect ſafety every purpoſe for which the other can be employed.